This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

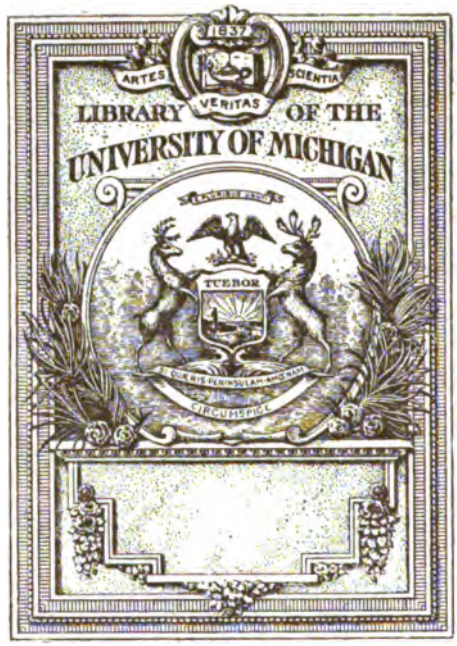
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

B 468931

Digitized by Google



THE GIFT OF
Estate of Prof. E. D. Campbell

Digitized by Google

...ical Library
QD
1
.R45
Cop. 2

Digitized by Google

Digitized by Google

REVIEW

—OF—

American Chemical Research

VOL. VI. 1900.

Contributed by Members of the Instructing Staff of the Massachusetts Institute of Technology.

ARTHUR A. NOYES, Editor.

REVIEWERS.

ANALYTICAL CHEMISTRY.....H. P. Talbot and F. G. Moore
BIOLOGICAL CHEMISTRY.....A. G. Woodman
CARBOHYDRATES.....G. W. Rolfe
GENERAL CHEMISTRY.....A. A. Noyes
GEOLOGICAL AND MINERALOGICAL CHEMISTRY.....W. O. Crosby and C. H. Warren
INORGANIC CHEMISTRY.....Henry Fay
METALLURGICAL CHEMISTRY AND ASSAYING.....H. O. Hofman
ORGANIC CHEMISTRY.....J. F. Norris
PHYSICAL CHEMISTRY.....H. M. Goodwin
SANITARY CHEMISTRY.....E. H. Richards
INDUSTRIAL CHEMISTRY.....A. H. Gill and F. H. Thorp

EASTON, PA.:
THE CHEMICAL PUBLISHING COMPANY.
1900.

Digitized by Google

Chem. Lib.
gift
Estate of Prof. E.D. Campbell
3-16-26

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. NO. 1.

ARTHUR A. NOYES, Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

The Development and Application of a General Equation for Free Energy and Physico-Chemical Equilibrium. BY GILBERT NEWTON LEWIS. *Proc. Am. Acad.*, 35, 1–38.—The title well indicates the general scope of the article, of which a detailed review is impracticable. The following laws and phenomena are considered by the author from the point of view of his general free energy equation: law of mass-action; law of constant distribution-coefficients; change of equilibrium with temperature including van't Hoff's equation; van der Waals' equation; heats of vaporization and vapor-pressure curves; specific heats of liquids and vapors; osmotic pressure of concentrated solutions; distribution of a solute between two solvents; single potential differences and electromotive force of concentration cells and of those composed of the same metal in contact with the same electrolyte dissolved in two different solvents. The mathematical treatment of the author is unusually clear and explicit.

Contribution to Our Knowledge of Aqueous Solutions of Double Salts.—*II. Chlorides.* BY HARRY C. JONES AND KENJIRO OTA. *Am. Chem. J.*, 22, 5–14.—*III. Chlorides and Bromides.* BY HARRY C. JONES AND NICHOLAS KNIGHT. *Am. Chem. J.*, 22, 110–141.—The electrical conductivity of aqueous solutions, varying in concentration from 0.5–1.0 mol. per liter to a very high dilution, of a considerable number of double chlorides and bromides, was measured and compared with the sum of the conductivities of the separate components of

Digitized by Google

the double salt, which were in many cases measured by the authors, but in others were taken from Kohlrausch. The following table presents the results in a greatly condensed form. Under v is given the volume in liters in which one gram-molecular weight of the double salt is dissolved, and under "per cent. diff." is given the percentage difference (unfortunately not calculated by the authors) between the sum of the conductivities of the separate component salts and the conductivity of the double salt. The four salts in the first horizontal series were investigated by Jones and Ota, the remainder by Jones and Knight.

$2KCl.ZnCl_2$.		$KCl.CdCl_2$.		$NaCl.AlCl_3$.		$2NH_4Cl.HgCl_2$.	
v	Per cent. diff.	v	Per cent. diff.	v	Per cent. diff.	v	Per cent. diff.
1	35.8	2	26.4	2.88	13.1	5	12.1
40	2.6	32	9.7	23.04	5.2	40	3.6
2000	0.6	1024	0.1	368.6	0.2	80	1.1

$2NaCl.ZnCl_2$.		$NH_4Cl.MgCl_2$.		$KCl.Mg.Cl_2$.		$SrCl_2.2CdCl_2$.	
1.14	47.5	1.92	13.1	1.95	17.3	2.18	34.2
24.16	9.4	30.72	5.0	31.2	12.5	34.9	13.6
773.	1.8	983.	2.4	998.	5.2	1116.	5.8

$2NaBr.3CdBr_2$.		$3NH_4Br.ZnBr_2$.		$BaBr_2.CdBr_2$.		KBr.CdBr.	
4.88	30.6	1.6	23.2	1.97	31.8	..	..
39.1	14.6	25.9	7.8	31.5	9.9	30	13.7
1563.	6.3	1039.	2.4	1249.	3.7	1200	5.7

$KCl.NH_4Cl$.		$KCl.2NH_4Cl$.	
1	11.9	1	14.1
32	3.8	32	3.7
640	—0.4	640	—0.8

The mixtures of potassium and ammonium chlorides were investigated to determine the effect on one another of two salts which do not form a double salt. In normal solutions of these salts it will be seen that the reduction of the dissociation in the mixture causes a difference in conductivity of 12–14 per cent. The very considerable magnitude of this effect makes somewhat doubtful the general conclusion of the authors that the (other) "double chlorides and bromides exist, to a considerable extent, in the more concentrated solutions, and are completely broken down by water only at very great dilutions." Their conclusion would seem to be warranted in the case of the zinc and cadmium double salts, but not in the case of those of aluminum, mercury, and magnesium. The freezing-point lowering caused by seven of the above double salts was also determined at various dilutions. From the fact that some of these, as well as some of the component salts, exhibit a *minimum* molecular lowering between 0.1 and 0.5 molecular, the authors conclude that the

Digitized by Google

freezing-point method is not suitable for the investigation of double salts. It would seem to the reviewer, however, that, in spite of the very considerable deviations from theory which no doubt exist, much could be learned from a direct experimental comparison of the component salts and their mixtures, and it is to be hoped that the authors will continue their investigation in this direction.

The Hydrolysis of Stannic Chloride. By WILLIAM FOSTER, JR. *Phys. Rev.*, 9, 41–56.—The author has determined the electrical conductivity of both concentrated and dilute aqueous stannic chloride solutions, and the increase in their conductivity with the time. He finds that very concentrated solutions (5.0–2.5 equivalents per liter) exhibit no time-change; that solutions of medium concentrations increase slowly in conductivity, while dilute ones (0.5–0.001 normal) change so rapidly that the initial velocity is not measurable. The maximum values reached by the dilute solutions are identical with that shown by hydrochloric acid of the same concentration. These results are substantially the same as those obtained by Goodwin (*this Rev.*, 3, 22) in his similar investigation on ferric chloride. The assumption of complete hydrolysis in dilute solutions is in complete accord with the freezing-point determinations of Loomis, the transference experiments of Hittorf, and the thermochemical measurements of Thomsen.

The Electrical Resistance of Lead Amalgams at Low Temperatures. By GEORGE W. GRESSMAN. *Phys. Rev.*, 9, 20–29.—The results are presented graphically. As the resistance suddenly decreases very markedly when the amalgam begins to freeze, the freezing-points can be readily determined. These are, for a moderate proportion of lead, *higher* than that of pure mercury; for example, the latter freezes at —38.8°, while a 4.2 per cent. amalgam freezes at —37.7°, a 7.1 per cent. one at —37.0°, and a 11.2 per cent. one at —30.1°.

Molecular Weights of Liquids, III. By CLARENCE L. SPEYERS. *J. Am. Chem. Soc.*, 21, 282–287.—The author shows graphically that, according to the experiments of Lehfeldt, in the case of mixtures of carbon tetrachloride with benzene and of the same with toluene, the partial vapor-pressure of each constituent is nearly proportional to its percentage molecular concentration, even between the extreme limits of 0 and 100 per cent., but that this is not true of mixtures of ethyl alcohol with benzene or with toluene. He concludes from these facts that the molecules of the constituents of the first-named mixtures are not, and that those of the last-named mixtures are, polymerized.

Digitized by Google

On Van't Hoff's Equation and the Molecular Weights of Liquids. By C. L. Speyers. *J. Am. Chem. Soc.*, 21, 725–732.

The Inversion of Sugar by Salts. By L. Kahlenberg, D. J. Davis, and R. E. Fowler. *J. Am. Chem. Soc.*, 21, 1–23.—The effect of most of the salts investigated by the authors has been determined previously by Walker and Aston (*J. Chem. Soc.*, 67, 576) or by Long (*J. Am. Chem. Soc.*, 18, 120, 693). The original features of the investigation are the application of the freezing-point lowering as a means of determining the extent of the inversion, and the measurement of the inverting effect of certain colored salts (copper sulphate and chloride and nickel sulphate) by that means. The authors' theoretical considerations in regard to hydrolysis are misleading, this phenomenon depending on the degrees of dissociation of water, of the salt itself, and of the acid and base composing it, and not at all, as the authors state, on the "ionizing tendency" of the separate ions. It may be further pointed out that the inverting effect of a salt of a weak base and the number of hydrogen ions its solution contains are a measure of its hydrolysis only in the case where the acid is completely dissociated; and, therefore, the fact that sulphates of the heavier metals invert less readily than the chlorides, does not necessarily signify a less degree of hydrolysis in the former salts, since much undissociated sulphuric acid may be present.

Derivatives and Atomic Mass of Palladium. By Willett Lepley Hardin. *J. Am. Chem. Soc.*, 21, 943–955.—Diphenyl-, dipyridine-, and diquinoline-pallad-diammonium chlorides and bromides, and di-piperidine-pallad-diammonium chloride were prepared by the addition of the bases to an acid solution of palladious chloride or bromide. The composition of the phenyl derivative is $Pd(NH_3ClC_6H_5)_2$; and the others are analogous, *e.g.* $Pd(C_5H_5NCl)_2$. The names assigned to the latter are, therefore, irrational. To determine the atomic weights of the metal, the author has reduced diphenyl-pallad-diammonium chloride and bromide and ammonium palladium bromide by hydrogen at a red heat. As a mean of the three series of closely checking determinations he gets 107.014 which is much higher than the values adopted by Clarke and Richards (106.36 and 106.5).

The Conversion of Ammonium Thiocyanate into Thiourea and of Thiourea into Thiocyanate. By John Waddell. *J. Phys. Chem.*, 2, 525–535.—The author shows that these two reactions reach the same state of equilibrium, the mixture then consisting of 21.2 per cent. of thiourea at 152°–153° and 20.9 per cent. at 160°–161°; and he finds that the velocity of each of them

Digitized by Google

corresponds as closely as the rather large experimental errors permit, with the requirements of the mass-action law for a reversible monomolecular reaction. The rate of the reactions is about twice as great at 160° as it is at 152°.

Pressure-temperature Diagrams for Binary Systems. By WILDER D. BANCROFT. *J. Phys. Chem.*, 3, 1–11.

Reversible Reactions. By JOHN WADDELL. *J. Phys. Chem.*, 3, 41–45.—The author shows, as has been previously done in detail by Ostwald (Lehrbuch, II, 2, 251, 257), that the velocity of a reversible first order reaction can be expressed by the equation $\frac{dx}{dt} = (k_1 + k_2)(\xi - x)$, in which k_1 and k_2 are the velocity constants of the opposing reactions and ξ is the value of x after equilibrium is reached; but that the corresponding simple expression, $\frac{dx}{dt} = (\xi - x)^2$, is not applicable to reversible second order reactions. An omission made by Ostwald in deriving the formula that does hold true in the latter case is pointed out.

Demonstration of the Phase Rule. By PAUL SAUREL. *J. Phys. Chem.*, 3, 69–71; 137–143.

Dissociation Studies, I. By WILDER D. BANCROFT. *J. Phys. Chem.*, 3, 72–94.—A graphical discussion of the equilibrium of two component systems.

The Electromotive Forces of Concentration Cells. By J. E. TREVOR. *J. Phys. Chem.*, 3, 95–106.—The author shows the effect of the heat of dilution (which is ordinarily neglected) on the general equations expressing the relation between electromotive force, concentration, and temperature.

Correction. By WILDER D. BANCROFT. *J. Phys. Chem.*, 3, 107.—This refers to an error in the calculation of the electromotive force between amalgams in an article by Cady (*J. Phys. Chem.*, 2, 554).

The Composition of Mixed Vapors, I. By HECTOR R. CARVETH. *J. Phys. Chem.*, 3, 193–213.

On Maxwell's Theorem. By PAUL SAUREL. *J. Phys. Chem.*, 3, 214–216.

Ternary Mixtures, IV. By WILDER D. BANCROFT. *J. Phys. Chem.*, 3, 217–231.

Solid Solutions. By HAMILTON P. CADY. *J. Phys. Chem.*, 3, 127–136.—The author states that naphthalene forms two series

Digitized by Google

of solid solutions both with monochloracetic acid and with glycolic acid, but hardly any evidence is presented to show that the supposed solid solutions are not simple mixtures of the two separate solid phases.

The Equilibrium of Stereoisomers, III. By WILDER D. BANCROFT. *J. Phys. Chem.*, 3, 144–155.

On the Molecular Weight of Sulphur in Carbon Bisulphide Solutions. By H. T. BARNES. *J. Phys. Chem.*, 3, 156–159.—The author calculates a value for the molecular weight from the density (*sic*) of the solutions.

Freezing-point in Ternary Mixtures. By JOHN WADDELL. *J. Phys. Chem.*, 3, 160–164.

Electrolytic Dissociation and Toxic Effect. By J. F. CLARK. *J. Phys. Chem.*, 3, 263–316; *Botan. Gaz.*, 28, 289.—The author has determined the minimum concentration of a number of chemical substances that suffices (1) to retard or make irregular the mycelial development and prevent the fruiting of the spores of five different forms of mold, (2) to inhibit entirely their development, and (3) to kill them. The second of these effects is most accurately determinable and is the one mainly discussed. The results in the following table show the number of mols of each substance required to produce an inhibiting effect equal to that of one mol of mercuric chloride when dissolved in the same quantity of water, namely, 7300 liters.

Potassium bichromate	1.1	Trichloracetic acid	321.
Silver nitrate	1.3	Hydrogen peroxide	375.
Potassium chromate	1.4	Ferrous sulphate	411.
Formaldehyde	5.	Copper sulphate	468.
Hydrocyanic acid	11.	Copper nitrate	479.
Cadmium nitrate	22.	Nitric acid	503.
Potassium cyanide	91.	Potassium hydroxide	593.
Nickel sulphate	120.	Sodium salicylate	650.
Ammonium hydroxide	182.	Sulphuric acid	732.
Cobaltous sulphate	206.	Hydrochloric acid	821.
Monochloracetic acid	207.	Zinc sulphate	2150.
Dichloracetic acid	229.	Potassium iodide	8775.
Acetic acid	296.	Ethyl alcohol	13164.

Various other neutral salts were also partially investigated; namely, potassium chloride, bromide, nitrate, and sulphate, and the potassium salts of the three chloracetic acids. All of these salts were only very slightly toxic, having from $\frac{1}{11}$ to less than $\frac{1}{81}$ of the effect of hydrochloric acid. A consideration of the data from a theoretical standpoint leads the author to conclude that

Digitized by Google

the hypothesis that "the ionized part of a dissolved substance and that only is chemically active" is in disagreement with his own physiological results and also those of others. The main reason for this conclusion is that the partially dissociated acids like acetic and the chloracetic acids have nevertheless a much more powerful toxic effect than hydrochloric acid and than their neutral salts which contain the same ions in much larger quantity. Without wishing to defend the almost obviously untenable assumption that undissociated molecules never enter into chemical reactions, the reviewer would point out that one important fact has been generally overlooked in the interpretation of the physiological results with reference to the dissociation theory; and that is the well-known *catalytic* effect of hydrogen ions. Thus it is by no means justifiable to assume that because the NO_3 ion has no appreciable toxic influence in a potassium nitrate solution, that the same is true of it in a nitric acid solution where hydrogen ions are simultaneously present. On the contrary, the fact that nitric is more toxic than hydrochloric acid would seem to be due more probably to the oxidizing effect of the NO_3 ion in *acid* solution than to the undissociated HNO_3 molecules.

Some Boiling-point Curves. By J. K. Haywood. *J. Phys. Chem.*, **3**, 317–327.—The author has determined the boiling-points at nearly constant pressure of alcohol-water, alcohol-ether, alcohol-carbontetrachloride, chloroform-carbontetrachloride, chloroform-methylalcohol, acetone-water, acetone-methylalcohol, acetone-ether, and acetone-carbontetrachloride mixtures. The results are presented graphically as well as in a tabular form.

Some Boiling-point Curves, II. By J. K. Haywood. *J. Am. Chem. Soc.*, **21**, 994–1001.—In this paper the boiling-points of mixtures of benzene with chloroform, with carbon tetrachloride, with ether, with acetone, and with methyl alcohol, and of methyl alcohol with ethyl alcohol, with carbon tetrachloride, and with ether are given, and the corresponding boiling-point curves are shown. Of these curves those for benzene with methyl and ethyl alcohols, and for methyl alcohol with carbon tetrachloride, alone show the existence of a minimum boiling-point. No very definite conclusions are drawn from the results.

The Deliquescence of Potassium Nitrate, Sodium Nitrate, and Ammonium Nitrate. By F. L. Kortright. *J. Phys. Chem.*, **3**, 328–333.—These three salts were placed on watch-glasses in desiccators over mixtures of sulphuric acid and water of known concentrations and vapor-pressures, gradually increasing the amount of water in the acid until the salt gained in

Digitized by Google

weight. The minimum pressures of water vapor causing deliquescence were thus found to be at 20° between 8.5 and 10.8 mm. for ammonium nitrate, between 12.3 and 13.5 mm. for sodium nitrate, and between 15.5 and 16.5 mm. for potassium nitrate. The vapor-pressure of pure water at 20° is 17.4 mm. The author has determined by extrapolation from existing data the vapor-pressures of saturated solutions of the salts and find these in agreement with the deliquescence pressures, as theory requires.

On the Stability of Equilibrium of a One Component System. By PAUL SAUREL. *J. Phys. Chem.*, 3, 334–336.

Notes on the Energy Theory. By J. E. TREVOR. *J. Phys. Chem.*, 3, 339–348.—The author differentiates the energy-changes that may take place in any system into (mechanical) work terms and into what he calls work-equivalent terms; the former are the product of forces into changes of space (distance, surface, or volume), and the latter, including all other energy-changes, are the product of potentials into changes of "quantity-coordinates."

Minimum Boiling-points and Vapor Compositions. By J. H. PETTIT. *J. Phys. Chem.*, 3, 349–363.—The author has determined the boiling-points of various mixtures of methyl alcohol and ether, methyl alcohol and chloroform, and methyl alcohol and acetone, and of the four pure substances. The last two mixtures have a minimum boiling-point when the concentration of the methyl alcohol is about ten per cent. The purpose of the work was to test the "theorem" of Bancroft that all miscible liquids whose temperature-vapor pressure curves intersect form mixtures with a maximum or minimum boiling-point at some concentration. Besides his own experiments the author takes into consideration those of others, and concludes that the theorem is fully supported by the facts.

Dissociation Pressure before H. Sainte-Claire Deville. By P. DUHEM. *J. Phys. Chem.*, 3, 364–378.—The author points out that in 1837, a French scientist, Georges Aimé, published a thesis in which he clearly stated the principle of constant dissociation-pressure, and communicated experiments confirming it, on calcium carbonate and hydrochloric acid, and sodium carbonate and various organic acids, in which he showed that these reactions ceased when the partial pressure of the carbon dioxide reached a definite value which was independent of the amounts of carbonate and acid brought together, of the capacity of the closed vessel, and of the presence or absence of air in the vessel.

Digitized by Google

On the Paraanisaldoximes. By H. R. CARVETH. *J. Phys. Chem.*, 3, 437–451.—This investigation is along the lines of previous ones from the same laboratory. (See *this Rev.*, 4, 97.)

On the Relation between Pressure and Evaporation. By EDWIN H. HALL. *J. Phys. Chem.*, 3, 452–456.—The author states that Nernst in deriving the equation for isothermal chemical equilibrium neglects the work done on the condensed substances that may be involved; and by making this correction the author derives a relation between temperature, total pressure, and vapor-density in the case of a pure solid or liquid. The reviewer would point out, however, that if the pressure is so high as to make the mentioned correction appreciable, the deviations from the simple gas laws would be so also; and the derived relation would have a different form.

Thermal Coefficients. By J. E. TREVOR. *J. Phys. Chem.*, 3, 523–547.—A complete mathematical treatment of the fundamental relations between pressure, volume, temperature, entropy, energy, free energy, the heat function, and the thermodynamical potential.

Hydrates in Solution. By WILDER D. BANCROFT. *J. Phys. Chem.*, 3, 551–554.—Nernst showed that, in the case of a hydrate of the formula, $A.nH_2O$, dissociating into its components A and n molecules H_2O, the mass-action law requires, since for not too concentrated solutions the concentration of the water is constant, that the concentrations of the hydrate and anhydrous substance be proportional to each other, or that the proportion of hydrated substance be independent of the concentration. This last statement, which is obviously to be understood to mean that the ratio of hydrate to the sum of hydrate and anhydrous substance is constant, is misinterpreted by the author so as to signify that the ratio of hydrate to the total amount of substance present, no matter what its molecular condition may be, is constant; and it is correctly shown by him that in this sense the statement is not applicable to hydrated salts which at the same time undergo electrolytic dissociation; for in that case the amount of undissociated anhydrous salt is, it is well-known, not proportional to the total amount of salt present. In regard to the equilibrium of hydrated salts in solution, the reviewer would add that it is just as probable that the ions are hydrated as that the undissociated molecules are.

The Specific Heat of Metals at Low Temperatures. By C. C. TROWBRIDGE. *Science*, 8, 6–11. The author has determined by the method of mixtures the mean specific heat of copper, iron, and aluminum between $+13$ and $-181.4°$, the temper-

Digitized by Google

ature of boiling oxygen obtained from liquid air, and finds the values 0.0868, 0.0914, and 0.1833 respectively, which are less than the mean specific heats between 23° and 100° by 7.6, 21.3, and 15.7 per cent., respectively.

H. M. GOODWIN, REVIEWER.

Note on the Coefficient of Expansion of Ice. BY EDWARD L. NICHOLS. *Phys. Rev.*, 8, 184–186.—The author gives the result of a direct determination of the coefficient of expansion of artificial ice cut in the form of a bar 45 cm. long, 12 cm. wide, and 5 cm. thick. The measurements were made on a dividing-engine, during a period when the temperature varied from —3° to —17°. The value 0.0000540 ± 0.0000020 was obtained for a mean temperature interval of —8° to —12°. This value agrees well with that obtained by a similar method by Struve (0.0000530), and that obtained by Plücker and Geissler (0.0000528) by the dilatometer method. The results of Brunner and of Marchand are much lower: the differences may be due to the specimen of ice employed.

The Electrical Conductivity of Non-Aqueous Solutions. BY AZARIAH T. LINCOLN. *J. Phys. Chem.*, 3, 456–494.—This article forms a continuation of a paper by Kahlenberg and the author on the Dissociating Power of Solvents (*this Rev.*, 5, 47). Additional qualitative determinations of the solubility of eighteen inorganic salts, mostly chlorides, were first made in twenty-nine organic solvents. Quantitative conductivity measurements were then made of solutions of ferric chloride in various organic solvents, as well as of several solutions of bismuth, antimony, aluminum chloride, and silver nitrate. The work and conclusions of other investigators are discussed and recapitulated in connection with the results obtained and the general conclusion is drawn that the dissociation theory and all other proposed theories fail completely to explain the results thus far obtained for non-aqueous conducting solutions. No rigid classification of solvents with reference to the conductivity of their solutions is made, although in general the Thomson-Nernst dielectric constant criterion is found to hold true.

The Influence of Substituents on the Electrical Conductivity of Benzoic Acid. BY ALFRED TINGLE. *J. Am. Chem. Soc.*, 21, 792–804.—The electrical conductivity of the alkali salts of the ortho and para halogen-substituted benzoic acids was determined at 25° C. for dilutions of 64 and 128 liters. The difference between the molecular conductivity of the same salts of two metals was found to vary widely with the acid with which the metals were in combination. The results are, however, consid-

Digitized by Google

ered only preliminary. If further measurements are to embrace but two dilutions, it would be much better to choose 37 or 64 liters and 1024 liters for the reasons pointed out by Bredig, and then compare the extrapolated μ_∞ values.

Differences of Potential between Metals and Non-Aqueous Solutions of Their Salts. By Louis Kahlenberg. *J. Phys. Chem.*, 3, 379–404.—The potential differences between silver and decinormal solutions of silver nitrate in various organic solvents were measured against a normal electrode by the usual compensation method with capillary electrometer. Also those between a number of other metals and decinormal solutions of such of their salts as were sufficiently soluble in organic solvents were determined. In all eighty-nine combinations including some twenty or more solvents were investigated. The conclusion drawn by Jones from a similar investigation with aqueous, methyl and ethyl alcoholic and acetone solutions, namely, that the electrolytic solution tension of a metal is a function of the solvent, is further verified by the more extensive data thus obtained. From the values of the potential difference of different metals in the various solvents, it is probable that the order of the metals in the voltaic series also varies with the solvent. Values of P, the electrolytic solution pressure, could not be computed for lack of data on the dissociation of the dissolved salts. On account of the fact that the electrolytic solution pressure varies with the solvent or mixture of solvents, the author seems to question the definiteness and value of the concept of the quantity as such. This seems to the reviewer unnecessary, for the same change of numerical value is observed in the solubility of all substances in different solvents; thus, ordinary solubility (that is, the solution pressure of the solute) and electrolytic solution pressure of a metal, are analogous quantities and are completely determined for a given substance by temperature, pressure, and the nature of the solvent.

The Specific Heat of Solutions which Are Not Electrolytes. By Wm. Francis Magie. *Phys. Rev.*, 9, 65–85.—The author deduces (under certain assumptions), the relation that the specific heats of solvent and solute are constant at all concentrations. In somewhat different form the same result has also been recently published by Schiller. To test this relation, the specific heat of various solutions, cane-sugar, dextrose, mannite, and urea in water, as well as of solutions in alcohol and aniline was determined by a modification of Pfaundler's method. The relation was found to be verified in many cases. Alcohol, either as solute or solvent, formed an exception. The data are as yet insufficient to warrant the general conclusion that the molecular heat of a dissolved substance is independent of the solvent.

Digitized by Google

On the Spectra of Krypton. By C. RUNGE. *Astro-phys. J.*, 10, 73.—The krypton was prepared as described by Ramsay and Travers from liquid air, and contained some argon. The gas emitted two spectra, one with Leyden jar or spark gap in the secondary circuit, the other without Leyden jar and spark gap, as is the case with argon. The lines due to krypton were measured, argon lines being eliminated by comparison with a photograph of an argon spectrum. It is interesting to note that the author identifies the lines of Ramsay's metargon with the carbon lines, as was first pointed out by Schuster. He suggests that they may be due to a compound of argon and carbon which is not decomposed by sparking in an atmosphere of oxygen.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

A Contribution to Our Knowledge of Dicarbonyl Cuprous Chloride. By WILLIAM APP JONES. *Am. Chem. J.*, **22**, 287–311.—Dicarbonyl cuprous chloride, prepared by passing carbon monoxide into cuprous chloride moistened with hydrochloric acid, was obtained in white crystalline plates which decomposed rapidly on drying. The compound was analyzed by decomposing it by heat, measuring the carbon monoxide liberated, and weighing the water; also, by determining the increase in weight of cuprous chloride when carbon monoxide is passed over it. The analyses show that the compound has the composition represented by the formula $Cu_2Cl_2.2CO.4H_2O$. The compound is decomposed by diminished pressure and by increase of temperature. The gas given off does not show any marked increase in chemical activity. Oxygen and chlorine cause only very slight decomposition, and hydrogen and nitrogen are without action. The general properties of dicarbonyl cuprous chloride are similar to those of other inorganic compounds containing carbon monoxide. It is tc be considered as a true chemical compound.

The Occlusion of Hydrogen by Metallic Cobalt and Other Metals. By GREGORY PAUL BAXTER. *Am. Chem. J.*, **22**, 351–364.—The amounts of hydrogen occluded by metallic cobalt, nickel, copper, and silver were determined by igniting the reduced metals in a current of air and weighing the water formed. The volume of occluded hydrogen depends upon the amount of surface presented, the purity of the metal, and the temperature of reduction. With cobalt the metal in the form of ingots occludes less hydrogen than that deposited in the form of foil by the electric current. The fine powder obtained from the reduction of the oxide occludes hydrogen in amounts varying with the purity

Digitized by Google

and the method of preparation. Perfectly pure oxide reduced in hydrogen at 400°–500° occludes about half as much gas as the impure oxide, containing small amounts of alkali and silica, the increased amounts in the latter case being due to the more porous material. The property of spontaneous oxidation was shown to be due not to the amount of hydrogen occluded but to the large amount of surface exposed to the air. Occlusion proceeds slowly at ordinary temperatures and is dependent upon the time of contact of the metal with hydrogen. Nickel is subject to the same influences as cobalt, the pure metal occluding only traces of hydrogen. The extent of occlusion varies with the fusion-points of the metals,—the higher the melting-point the greater is the occlusion. Silver and copper, whose melting-points are close to the temperature of reduction, consequently occlude smaller amounts of gas, because the sintering together of the metal is greater, thus diminishing the extent of the surface. Pure silver and copper occlude only small amounts of hydrogen.

The Electrolysis of Metallic Phosphate Solutions. By HARVEY M. FERNBERGER AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, 21, 1001–1007.—The current density, voltage, dilution, and temperature are given for the quantitative separation of copper from iron, aluminum, chromium, cobalt, nickel, zinc, and manganese using solutions of their phosphates. Mercury and nickel may also be precipitated quantitatively from phosphate solutions.

Observations upon Tungsten. By EDGAR F. SMITH. **I. The Action of Sulphur Monochloride upon Tungsten Trioxide.** By HERMANN FLECK. **II. Tungsten Alkyls.** By E. A. BARNETT. **III. Tungsten Alkyls.** By CLARENCE HALL. **IV. Esters of Tungstic Acid.** By CLAUDE DUGAN. **V. The Atomic Mass of Tungsten.** By WILLETT L. HARDIN. *J. Am. Chem. Soc.*, 21, 1007–1027.—

I. By heating finely divided wolframite, scheelite, tungsten trioxide, or tungsten dioxide, with sulphur monochloride to 145° tungsten oxytetrachloride, $WOCl_4$, was formed in scarlet-red crystals which decomposed readily in the air. This compound is soluble in carbon disulphide and sulphur monochloride, and may be purified by sublimation. It has been shown that there is a crystalline form of tungsten trioxide which is insoluble in sulphur monochloride at 145°. Pure sulphur monochloride does not attack metallic tungsten.

II. It was impossible to obtain tungsten alkyls either by heating metallic tungsten with methyl iodide, or by the action of mercury ethide upon tungsten hexachloride.

III. An unsuccessful attempt was made to prepare tungsten alkyls from zinc methide and tungsten hexachloride.

Digitized by Google

IV. Esters could not be obtained by treating tungsten oxytetrachloride with alcohols. The products indicated that the reaction was incomplete.

V. The author has shown that the usual methods of determining the atomic weight of tungsten are not trustworthy. Tungsten trioxide prepared from tungsten oxychloride cannot be obtained pure and its reduction to metal in a current of hydrogen consequently gives varying results for the atomic weight. The metal does not occlude hydrogen to any extent. By oxidation of the metal to tungsten trioxide results were obtained which varied from 184.1 to 184.8 because of the volatility of the oxide. Analyses of tungsten oxychloride, and of barium metatungstate, were likewise untrustworthy. The most probable value the author considers to be 184, until more accurate methods can be devised.

Note on the Color of Chlorine Solutions. By E. H. Sarles. *J. Am. Chem. Soc.*, 21, 1038.—A preliminary note.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. No. 2.

ARTHUR A. NOYES, Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

The Determination of Nickel in Nickel-Steel. BY GEO. WM. SARGENT. *J. Am. Chem. Soc.*, **21**, 854–857.—The steel is dissolved in hydrochloric acid, the iron oxidized by nitric acid (the excess of which is removed by evaporation to dryness), and the hydrochloric acid solution of the residue treated with ether, which has previously been shaken with strong hydrochloric acid. A single treatment was found to suffice. The aqueous solution containing the nickel is treated with ammonia and the acidified filtrate with sulphuretted hydrogen to remove any copper. The filtrate is concentrated, ammonia is added in slight excess, then measured quantities of solutions of silver nitrate and potassium iodide, after which a standard potassium cyanide solution is added until the opalescence due to silver iodide just disappears. Compare the method of Chase (Blair: *The Chemical Analysis of Iron, Appendix to Third Edition*); and Campell and Andrews: *J. Am. Chem. Soc.*, **17**, 125.

The Quantitative Estimation of Boric Acid in Tourmaline. BY GEORGE W. SARGENT. *J. Am. Chem. Soc.*, **21**, 858–888.—The results of the experiments described in this paper are summarized at its close, and cannot well be further condensed. The paper includes a historical résumé of earlier work in this field, and a bibliography.

Electrolytic Determinations and Separations. BY LILY G. KOLLOCK. *J. Am. Chem. Soc.*, **21**, 911–928.—The methods for

Digitized by Google

the electrolytic determination or separation of a considerable number of metals have been subjected to examination with a view of defining with exactness the conditions essential for success, especially with respect to amperage, voltage, and current density. Reference to the original article is necessary for the detailed results.

The Precipitation of Copper by Zinc. By JOHN C. SHENGLE AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **21**, 932–933.—The authors find that copper precipitated from its solutions by means of zinc always contains small, variable quantities of the latter metal.

Note: Analysis of Zinc for Cadmium and Lead. By P. A. MACKAY. *J. Am. Chem. Soc.*, **21**, 940–941.—The greater portion of the zinc is dissolved in hydrochloric acid, leaving the lead and cadmium deposited upon the residual zinc. After solution in nitric acid the lead is removed as sulphate, the cadmium thrown down as sulphide, dissolved in hydrochloric acid, a known solution of zinc chloride is added, and the whole titrated with potassium ferrocyanide.

Notes on the Determination of Sulphur in Pig-Iron. By M. J. MOORE. *J. Am. Chem. Soc.*, **21**, 972–975.—The author finds marked differences in the results obtained by volumetric determinations of sulphur made upon shot samples and sand samples of pig-iron taken from the same mixer. The results obtained from the shot samples are low as compared with the gravimetric determinations.

Note: The Determination of Chromium in Steel. By R. W. MAHON. *J. Am. Chem. Soc.*, **21**, 1057–1060.—The author states the results of experiments made to determine exact conditions as to volume, quantity of reagents, etc., which are best for use in McKenna's method for the estimation of chromium (*Proc. Eng. Soc. Western Penn.*, **11**, *No.* 6).

The Direct Determination of Available Phosphoric Acid. By F. P. VEITCH. *J. Am. Chem. Soc.*, **21**, 1090–1094.—The author shows that the discrepancies in the method of Ross (*U. S. Dept. Agr., Div. Chem., Bull.* **38**, 17), as compared with the official method, arise from the failure to take account of the phosphoric acid in the washings of the citrate-insoluble material. He also makes a comparison of the official method with the citrate and molybdate methods, as applied to the combined filtrates containing the citrate-soluble and water-soluble phosphoric acid. The molybdate method yields satisfactory results.

Digitized by Google

Note upon the Determination of Nitrogen in Fertilizers Containing Nitrates. By F. P. Veitch. *J. Am. Chem. Soc.*, 21, 1094–1095.—The author describes a modification of the Gunning method (*U. S. Dept. Agr., Div. Chem., Bull.* 46) slightly different from that described by Fields (*this Rev.*, 3, 32). The fertilizer is treated with the mixture of sulphuric and salicylic acids in the cold.

The Determination of Graphitic Carbon in Cast and Pig Iron. By Allen P. Ford and I. M. Bregowsky. *J. Am. Chem. Soc.*, 21, 1113–1115.—The use of a platinum Gooch filter instead of a paper filter, and of hydrofluoric acid to remove the silica, is recommended by these authors. They find that graphitic carbon is slowly oxidized by nitric acid of 1.20 sp. gr. on boiling, but is not affected by acid of 1.12 sp. gr.

W. H. Walker, Reviewer.

The Iodometric Determination of Gold. By F. A. Gooch and F. H. Morley. *Am. J. Sci.*, 158, 261–266.—In a recent attempt to determine small quantities of gold in solution by allowing auric chloride to react with potassium iodide, and titrating the iodine liberated with sodium thiosulphate, Peterson (*Ztschr. anorg. Chem.*, 19, 63) found that one-half more thiosulphate is consumed than would be required if the thiosulphate were simply converted to tetrathionate in the usual manner. The authors have studied this reaction and find no evidence of any variation from the usual reaction of sodium thiosulphate and iodine. The reduction of the auric salt and the consequent liberation of iodine is, however, dependent upon the volume of the solution, the mass of iodine present, and the time of action. By using one-thousandth normal solutions the process is made fairly accurate.

On the Volumetric Estimation of Cerium. By Philip E. Browning. *Am. J. Sci.*, 158, 451–459.—The iodometric method of Bunsen (*Ann. Chem.* (Liebig), 105, 49) for the determination of cerium is modified in that a glass-stoppered bottle is used in the place of a flask with the neck drawn out and closed by heat. As a further check on the accuracy of the method, the iodine set free by the reaction of cerium dioxide and potassium iodide was distilled from a retort in a stream of carbon dioxide and received in a solution of potassium iodide. The results obtained by both these methods are very satisfactory. An attempt to estimate cerium dioxide by reduction with arsenious acid proved unsatisfactory. The statement by Stolba (*Ztschr. anorg. Chem.*, 19, 194) that cerium could be estimated in the same manner as calcium oxalate, by oxidizing the precipitated cerium oxalate with standard potassium permanganate is proved correct.

Digitized by Google

On the Estimation of Thallium as the Chromate. By PHILIP E. BROWNING AND GEORGE P. HUTCHINS. *Am. J. Sci.*, 158, 460–462.—The authors have repeated the work of Baubigny (*Chem. News*, 64, 239) on the gravimetric estimation of thallium, and obtained results which confirm his statements. Instead of weighing the thallium chromate precipitate, the thallium may be estimated volumetrically by determining the amount of chromate in the filtrate by means of standard solutions of arsenious acid and iodine, and, by difference, the amount of chromate combined with the thallium. The results compare very favorably with those by the gravimetric method.

PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

Directions for Certain Alkaloidal Assays. By H. M. GORDIN AND A. B. PRESCOTT. *Am. J. Pharm.*, 71, 462–473.—This paper is a résumé of the work done by the authors on the extraction of alkaloids and their volumetric estimation as higher periodides. It contains the directions for the general method of alkaloidal extraction and assay, and for the modification of the general method in special cases.

Further Work upon the Estimation of Alkaloids and the Assay of Alkaloidal Drugs. By H. M. GORDIN AND A. B. PRESCOTT. *Am. J. Pharm.*, 71, 514–525.—In this paper the authors present some of the experimental data upon which they have based their methods for alkaloidal assay, discussing the composition and properties of the periodides of emetine and of hydrastine, and giving directions for the assay of hydrastis and the hot extraction of opium. A table is appended showing the comparative merits of the gravimetric and the iodometric methods of assay.

A Simple Alkalimetric Method for the Estimation of Salt-forming Alkaloids with the Aid of Phenolphthalein as Indicator. By H. M. GORDIN. *Pharm. Archives*, 2, 313–318.—The direct alkalimetric estimation of alkaloids is in many cases unsatisfactory, owing to the fact that the end-point is not very sharp. In some alkaloidal salts the acid acts as if wholly free, so that indicators show no end-point at all until the acid used is all neutralized. Often it is necessary to make the titration in a solution colored by non-alkaloidal matter. To obviate these difficulties it is proposed to dissolve the alkaloid in an excess of standard acid, precipitate the alkaloid by some neutral alkaloidal reagent, filter, and determine the free acid in the filtrate. As there is no alkaloid in the filtrate to interfere with the indicator, phenolphthalein can be used with satisfactory results.

Digitized by Google

For ordinary cases either Mayer's or Wagner's reagent may be used as a precipitant. Berberine and colchicine cannot be estimated by this method.

Modified Assay Process for Fluid Extracts. By A. B. Lyons. *Pharm. Rev.*, 17, 558–560.—For the extraction of alkaloids from preparations containing much tannin, such as fluid extract of cinchona bark, it is recommended to shake a definite volume of the extract with a dilute alcoholic solution of ferric chloride, made alkaline with ammonia. The mixture is allowed to settle, is then filtered, and an aliquot part of it is evaporated with dilute hydrochloric acid to drive off the greater part of the alcohol; the acid solution is then shaken with ether to remove the fats and waxes. Finally the solution is made alkaline with ammonia, and shaken out with ether, as usual. The results obtained are satisfactory. If desired, a solution of basic lead acetate may be substituted for the ferric chloride.

A Note on the Assay of Opium. By William R. Lamar. *Am. J. Pharm.*, 72, 36–39.—The author has modified the U. S. P. method for the assay of opium by increasing the amount of alcohol which is added to the aqueous extract of the opium, in this way getting rid of the objectionable matters in solution.

On Acetic Acid as a Substitute for Ethyl Alcohol in Extracting the Active Principles of Some Officinal Drugs. By Edward R. Squibb. *Am. J. Pharm.*, 72, 1–9.—In this paper, which is the third in the series, the author presents the results of further experience in the use of acetic acid as a menstruum, and gives in detail the procedure for the assay of belladonna root.

The Phenylhydrazine Test for Sugar in the Urine. By I. H. Coriat. *Boston Medical and Surgical J.*, 141, 518–519.—The author has studied the phenylhydrazine test for sugar with especial reference to the examination of urine, and finds that substances that interfere with Fehling's or Nylander's reagents do not interfere in any way with this test. It is not necessary to remove albumin, and the various sugars can be recognized by their crystalline forms and melting-points. The limit of delicacy of the test is about one part in 10,000.

Lemon Flavoring Extract and Its Substitutes. By A. S. Mitchell. *J. Am. Chem. Soc.*, 21, 1132–1137.—The author describes the methods which he has found most satisfactory in the examination of lemon extract. In the absence of sugar the oil of lemon is readily estimated by polarizing the extract in a 200 mm. tube and dividing the result in degrees by 3.4. The oil may also be separated by the centrifugal machine and meas-

Digitized by Google

ured in an ordinary Babcock skim-milk bottle. Tests for various minor adulterants are described and a table is given showing the results of examination of several characteristic extracts.

On Rapid Methods for the Estimation of the Weight of Suspended Matters in Turbid Waters. By CHARLES L. PARMELEE AND JOSEPH W. ELLMS. *Tech. Quart.*, 12, 145–164.—Many of the surface waters of the central and western parts of the United States contain such quantities of suspended matters, mainly clay, that this question becomes one of considerable importance. The standard method of estimation of the suspended material is a gravimetric one. In order to secure a more rapid method, comparative trials of the following methods were made on Ohio river water: (1) The water was compared with standards containing known amounts of suspended matter; (2) the amount of light which is absorbed in its passage through the water was measured directly; (3) determinations were made of the vanishing-depth of a bright wire; (4) a method was employed based on the use of the diaphanometer. This instrument consists essentially of a tube with a transparent diaphragm at the lower end. Light is reflected up through the tube, water being admitted until an image painted on the diaphragm just disappears. The results of a number of experiments show that by the use of standard clay solutions reasonably close estimations can be made when the suspended matters amount to less than 25 parts per million. When the water contains more than this quantity of suspended matter, the diaphanometer method gives results which agree fairly well with the gravimetric estimations. Greater variations in the character of the suspended particles is found to increase the error in the use of any of the rapid methods.

Silica Standards for the Determination of Turbidity in Water. By GEORGE C. WHIPPLE AND DANIEL D. JACKSON. *Tech. Quart.*, 12, 283–287.—The authors have substituted silica from diatomaceous earth for the kaolin previously used, and get a uniformity of results which, taken in connection with its ease of use, lead them to recommend it.

F. H. THORP, REVIEWER.

Notes on the Analysis of Dynamite and Gelatine-Dynamite. By F. W. SMITH. *J. Am. Chem. Soc.*, 21, 425–431.—Typical analyses of a dynamite and of a gelatine-dynamite, with notes and precautions, are given in detail. Also various notes on the use of the nitrometer, its standardizing by the use of potassium nitrate, testing for leaky stop-cocks, etc., are communicated.

Digitized by Google

Tannin Determination—Estimation of Reds without the Use of Filter-paper. By J. N. Hurty. *Leather Manufacturer*, 10,33.—Two methods were tried. First, simple filtration through ignited asbestos in a Gooch crucible was used. Second, the material was subjected to treatment in a centrifugal machine running 2000 revolutions per minute, for 30 minutes, to separate the reds in the extract. With chestnut-oak extract, an addition of barium sulphate is necessary, to cause complete precipitation of the reds. Test analyses of quebracho, chestnut-oak extract, and spent tan (oak bark) are given, and compared with the results obtained by filtering through paper. It is concluded that neither asbestos nor barium sulphate absorbs tannin.

A. H. Gill, Reviewer.

The Determination of Carbon Monoxide, Methane, and Hydrogen by Combustion. By L. M. Dennis and C. G. Hopkins. *J. Am. Chem. Soc.*, 21, 398–410.—The apparatus employed is a modified Winkler grisoumeter, with an adjustable leveling bulb, using mercury as the confining liquid. The gas to be determined is introduced into the grisoumeter, the spiral brought to a suitable temperature, and a quantity of oxygen more than sufficient to burn it passed in at a rate not exceeding 20 cc. per minute. The combustion takes place quietly and without the appearance of a flame. The results upon the single gases were correct within 0.1 per cent., and upon mixtures within 0.1–0.2 per cent. The apparatus is simple and easy of construction and manipulation, and will be welcomed by all having occasion to make gas analyses.

The Preservation of Hübl's Reagent. By R. Bolling. *Am. Chem. J.*, 22, 213–214.—The results indicate that the alteration in the solution is rapid, and is retarded but slightly by the use of absolute alcohol or by the exclusion of air and light.

J. F. Norris, Reviewer.

The Valuation of Saccharin. By E. Emmet Reid. *Am. Chem. J.*, 21, 461–471.—The amount of saccharin in a commercial sample, which always contains *p*-sulphaminebenzoic acid, can be determined by saponifying the benzoic sulphinide and estimating the ammonia formed. The saponification is effected by heating at 100° for several hours with 71 per cent. sulphuric acid, or by boiling with dilute hydrochloric acid under definite conditions. The latter method gives more trustworthy results, as sulphuric acid causes a slight decomposition of the sulphamine acid. The methods of analysis were applied with excellent results to a number of samples of commercial saccharine and to mixtures of known composition. Boiling sodium hydroxide

Digitized by Google

solution readily converts benzoic sulphinide into the sodium salt of *o*-sulphaminebenzoic acid, but does not break this acid down. This fact renders a determination of saccharine in the presence of ammonium salts possible. The nitrogen in *p*-sulphaminebenzoic acid was determined by heating the acid with concentrated sulphuric acid at 230°–260°, making alkaline, and titrating the ammonia set free.

Hydrastine Hexaiodide, and the Assay of Hydrastis Canadensis, by Means of Standard Iodine for Hydrastine and of Standard Potassium Iodide for Berberine. By H. M. GORDIN AND A. B. PRESCOTT. *J. Am. Chem. Soc.*, 21, 732–741; *Am. J. Pharm.*, 71, 257–267.—When a dilute solution of hydrastine is added to a large excess of a solution of iodine in potassium iodide a hexaiodide is precipitated. By determining the excess of iodine the amount of the alkaloid can be estimated. If iodine is added to a solution of hydrastine, a triiodide is formed. Berberine is quantitatively precipitated by potassium iodide. A detailed account of the assay of hydrastis canadensis is given.

INDUSTRIAL CHEMISTRY.

F. H. THORP, REVIEWER.

Action of a Hard Water on Certain Metals. By JAS. LEWIS HOWE AND J. L. MORRISON. *J. Am. Chem. Soc.*, 21, 422–425. —The experiments of the authors show that hard water containing an excess of carbon dioxide and considerable magnesia, acts readily upon zinc, corrodes brass, and attacks lead; but that aluminum is not attacked, and in the absence of air iron is only slightly dissolved.

Glass-making in the United States. By ROBERT LINTON. *Eng. Min. J.*, 68, 454.—Having described briefly the methods and materials used in glass-making, the writer gives calculations of the cost of plate, window, flint, and bottle glass-making, comparing with these the cost of glass-making in Germany. A noticeable variation between the costs of fuel and labor in the two countries is shown. An interesting review of the progress of the industry in this country is included, and it appears that machines are being rapidly introduced for making fruit-jars, lamp chimneys, and similar articles, thus replacing the costly manual labor. Continuous tank furnaces are displacing the old pot furnaces, and automatic weighing and mixing machines are replacing the often careless "boss mixer." For fuel, gas is almost universally used; natural gas still plays an important though steadily diminishing part, while producer gas, although more troublesome to use than natural gas, has steadily replaced

Digitized by Google

coal. Oil is mainly employed for secondary furnaces, as reheating and flattening ovens, etc. Several analyses of materials and different varieties of glass are given.

Manufacture of Sodium Nitrite. By M. A. Darbon. *Am. Gas Light J.*, 81, 575.—Purified sodium nitrate is melted in large cast-iron vessels, thus evaporating hygroscopic water and decomposing iodates, etc. The nitrate fuses at 310° C. and the temperature is raised to 400°–420° C. before adding any lead. The lead must be pure and free from other metals, especially antimony. It is made into thin sheets, and 280 parts of lead are used for each 100 parts of sodium nitrate. The lead is gradually added while stirring constantly. The charge must not be overheated, or the vessel will be rapidly destroyed. The temperature is kept down by adding cold nitrate, if necessary, or by drawing the fire. After all lead is added, stirring is continued for some time, and then the charge is ladled out into cold water, being poured in a fine stream while stirring constantly. By the decomposition of the sodium nitrate some caustic soda is formed, which dissolves some of the lead oxide formed. The whole solution is therefore neutralized with nitric acid, which precipitates lead hydroxide and forms some sodium nitrate. Lead nitrate or sulphuric acid may also be used for this neutralizing, but the latter forms sodium sulphate, which separates as anhydrous salt in the concentration vessels. The aqueous solution thus contains nitrite, unchanged nitrate, caustic soda holding lead oxide in solution, and all soluble impurities. The insoluble residue is made up of metallic lead, litharge, and lead peroxide. The solution is diluted to 6°–8° Bé. before neutralizing with nitric acid, and this is added as long as a precipitate continues to fall. Sodium nitrite has a neutral reaction, and the commercial product should not show an alkaline reaction. The solution is decanted and evaporated in iron pans to 42°–45° Bé, measured in the hot liquor, and then cooled and allowed to crystallize. The pure crystals are recrystallized, and the pure crystals "centrifled," washed, dried at 50° C., and packed. A method of titrating nitrite solution with standardized permanganate solution is explained.

A. G. Woodman, Reviewer.

The Comparative Value of Certain Reagents for Removing Lime and Magnesia from Natural Waters for Industrial Uses. By Martin L. Griffin. *J. Am. Chem. Soc.*, 21, 665–678.—The reagents used as coagulants were sodium hydroxide, sodium phosphate, sodium fluoride, sodium aluminate, and barium hydroxide. These were tried on simple calcium and magnesium solutions and also on natural waters. While no one reagent

Digitized by Google

was found to be best in all cases, sodium hydroxide gave the best results with the majority of waters. Sodium fluoride is to be preferred for waters containing calcium sulphate and chloride, while barium hydroxide is most serviceable in the treatment of acid mine waters.

The Engineering Chemistry of Boiler Waters. By HENRY LEFFMANN. *Am. Gas Light J.*, 69, 416–418.—This paper is a discussion of the causes of corrosion and scale-forming in boilers and of various methods for preventing this.

A. H. GILL, REVIEWER.

Chemical Analysis of Wyoming Petroleum. By E. E. SLOSSON. *School of Mines, Univ. Wyo., Bull.* 3, 26–31.—The three petroleums examined are all very heavy, having a specific gravity of 0.915–0.935 and a flash of 123°–134° C. No considerable quantity of oil will volatilize under 270° C., at which temperature it cracks, giving light and heavy products. On redistillation the oils break up still further into undesirable mixtures. The crude petroleum is a better lubricant than any products obtained from it. The three samples contained 0.3, 0.1 per cent. and no sulphur, respectively.

E. H. RICHARDS, REVIEWER.

The Quality of the Boiler Water Supply of a Portion of Northern Illinois. By JAMES A. CARNEY. *Trans. Am. Inst. Min. Eng.*, 27, 130–139.—This paper is a contribution to the solution of the problem of the best feed water for locomotive boilers. Thirty-eight samples were taken from the possible sources of supply along the C. B. & Q. R. R. between Chicago and Burlington, a distance of about 200 miles. The average of the three classes of water is given in grains per U. S. gallon. The total solids in the surface waters were 16.62, in the shallow wells 37.99, and in the deep waters 72.11 grains, while the incrusting solids were 14.88, 35.09, and 23.30, respectively, for the three classes of waters. Surface waters are recommended wherever practicable, as containing not only less incrusting solids but less sodium salts, which, if present in any quantity, give rise to "foaming."

BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

Asterionella: Its Biology, Its Chemistry, and Its Effect on Water Supplies. By GEORGE C. WHIPPLE AND D. D. JACKSON. *J. N. E. Water Works Assoc.*, 14, 1–23.—Having been enabled to collect Asterionella quite pure and in considerable

Digitized by Google

quantities, the authors have made a complete analysis of it. The most striking feature of the analytical results is the high percentage of mineral matter, amounting to 57.52 per cent. of the dry weight of the organism; 49.48 per cent. of the dry weight is silica, which forms the cell wall. The authors have calculated the amount of certain materials, such as silica and manganese, which a water must contain in order to admit of the growth of the organism, basing their calculation on the weight of an Asterionella cell. In order to check the growth of the organism, it is recommended to limit the supply of available food material, especially of silica, manganese, iron, and nitrates.

The Amount of Humus in Soils and the Percentage of Nitrogen in the Humus, as Affected by Applications of Air-slaked Lime and Certain Other Substances. By H. J. Wheeler, C. L. Sargent, and B. L. Hartwell. *J. Am. Chem. Soc.*, 21, 1032–1037.—The authors have carried out experiments on the effect of various fertilizing materials on the amount of humus in soils. They find that, without exception, the addition of air-slaked lime or gypsum lowers the total amount of humus, but that the percentage of nitrogen in the humus is increased. When sodium nitrate was applied without the use of lime, the percentage of humus and of nitrogen reached a maximum.

A Contribution to the Chemistry of Butter-fat. II. The Chemical Composition of Butter-fat. III. The Chemistry of Rancidity in Butter-fat. By C. A. Browne, Jr. *J. Am. Chem. Soc.*, 21, 807–827; 975–994.—II. By methods involving fractional precipitation of the insoluble acids from alcohol, and solution of the soluble acids in water at different temperatures, the author has made a complete analysis of butter-fat with the following results:

Acid.	Per cent. of acid.	Per cent. of triglycerides.
Dioxystearic	1.00	1.04
Oleic	32.50	33.95
Stearic	1.83	1.91
Palmitic	38.61	40.51
Myristic	9.89	10.44
Lauric	2.57	2.73
Capric	0.32	0.34
Caprylic	0.49	0.53
Caproic	2.09	2.32
Butyric	5.45	6.23
Total	94.75	100.00

III. The three factors most active in the production of rancidity in fats are openness to air, exposure to light, and degree of warmth. One of the chief changes produced consists in the decomposition of the oleic acid, which is partly broken down

Digitized by Google

into compounds having an aldehydic nature, as well as into lower oxy-acids. Another marked effect of rancidity upon fats is in the marked decrease in the heat of combustion.

Notes on Testing Soils for Application of Commercial Fertilizers. By H. A. Weber. *J. Am. Chem. Soc.*, 21, 1095-1099. —Small samples of soils of about five kilograms each are mixed with various fertilizers. Several seeds of different kinds of grain are added to each sample, and the differences in the growth and condition of the plants noted from time to time. From the results of this simple test the needs of the particular soil can be readily learned.

Studies on Bread and Bread-making. By Harry Snyder and L. A. Voorhees. *U. S. Dept. Agr., Expt. Sta. Bull.* 67, 1–51.—Among the more important changes which have been found to take place in baking bread the following may be noted: (1) The starch undergoes both physical and chemical changes. From 3 to 4 per cent. of soluble carbohydrates are found in bread, showing that less than eight per cent. of the total starch is rendered soluble. (2) The amount of water-soluble proteid which is formed depends upon the degree of acidity of the dough. (3) The physical properties of bread are determined largely by the expansive power of the gluten of the flour. (4) At high temperatures there is a partial volatilization of the vegetable fat in bread, especially when escaping water vapor is present; and, furthermore, an oxidation of residual organic matter takes place. When an animal fat is added there seems to be an occlusion of fat, probably due to the formation of dextrin.

A Description of Some Chinese Vegetable Food Materials and Their Nutritive and Economic Value. By Walter C. Blasdale. *U. S. Dept. Agr., Expt. Sta. Bull.* 68, 1–48.—A number of species of Chinese vegetables, as found in the San Francisco market, amounting to about 50 varieties in all, were collected, identified botanically, and in most cases submitted to chemical analysis. The analytical methods employed were, in the main, the official ones. The results which are given add much to our knowledge of the chemical composition of Chinese food materials.

Commercial Fertilizers. *N. J. Agr. Exp. Sta., Bull.* 139, 1–59; *Me. Agr. Expt. Sta., Bull.* 53, 57–70; *N. Y. Agr. Expt. Sta., Bull.* 160, 63–151.

On Nitrites as a Product of Combustion. By Edward W. Axson. *Tech. Quart.*, 12, 219–225.—The author has made quantitative experiments on the amount of nitrites formed dur-

Digitized by Google

ing combustion and in breathing, in order to determine the best conditions for absorption and the comparative amounts of nitrite obtained from various sources. A test was also made of the physiological effects of breathing air high in nitrites.

The Action of Hepatic, Renal, and Other Cells on Phenol and Indol, under Normal and Pathological Conditions. By C. A. Herter and A. J. Wakeman. *J. Expt. Medicine*, 4, 307–326.—In this study of the natural defenses of the organism against injury through chemical agencies indol and phenol were selected for use, because they are normal products of proteid cleavage in the intestine, and are often found in abnormal quantities in the course of digestive derangement. In the "contact" method of study the organs of healthy rabbits were chopped into fine bits, and a definite weight brought into contact with weak solutions of phenol and indol. After some time the mixture was distilled, and the presence of phenol and indol shown in the distillate by color reactions. In the "infusion" method intravenous injections were made of solutions of phenol and indol. In general, the order of activity of the cells was found to be liver, kidney, muscle, brain, and blood. Only in the case of the liver was it possible to get satisfactory results under pathological conditions. The prolonged action of chloroform and of ether decreased the power of the liver cells in the conversion of phenol and indol. Alcohol was found to be without appreciable effect. From these and further experiments with a number of poisons the conclusion is drawn that no pathological conditions which can be induced in the liver during life are capable of destroying or limiting the activity of its cells in causing the conversion of phenol and indol.

The Relation of Dextrose to the Production of Toxin in Bouillon Cultures of the Diphtheria Bacillus. By Theobald Smith. *J. Expt. Medicine*, 4, 373–397.—The author has found that contrary to the usual ideas dextrose is not in itself inimical to toxin production, but that a certain amount of it is necessary for abundant toxin accumulation. If added in quantities not greater than 0.2 per cent. to peptone bouillon freed from fermentable acid-producing substances, it leads to the maximum accumulation of toxin by utilizing the available peptone to the best advantage. The lesser yield of toxin in ordinary unfermented peptone bouillon containing muscle sugar may be explained by the assumption that the acid products of muscle sugar are different from those of dextrose and non-utilizable, or else that the bouillon contains unknown inhibitory substances removed during fermentation.

The Origin of Fat from Protein in the So-called Fatty Metamorpohsis of Phosphorus Poisoning. By Alonzo

Digitized by Google

ENGLEBERT TAYLOR. *J. Expt. Medicine*, 4, 399–407.—In this study of fatty degeneration a certain number of frogs, all of the same sex, of approximately the same weight, selected at the same time, and kept awake and without food for the same period, were divided into equal groups. One-half of the number were poisoned with phosphorus, the other half formed a control group. The dried residue of the poisoned frogs weighed 16.5 per cent. less than that of the control group; it contained 18.45 per cent. less protein, 22.64 per cent. less fat, and about 13.3 per cent. less glycogen. While these results differ from those of other investigators, it is felt that the more rigid conditions obtaining in the present study render the conclusion that no fat is produced from protein the more probable one.

Experiments on the Conservation of Energy in the Human Body. BY W. O. ATWATER AND E. B. ROSA. *U. S. Dept. Agr., Expt. Sta. Bull.* 63, 74–94; *Phys. Rev.*, 9, 238–251. —The authors describe one or two of the earlier experiments made on men with their modified form of respiration calorimeter. They find a fairly close correspondence between the estimated income and the measured outgo of energy, the difference being practically less than the limits of experimental error. The experiments, in general, demonstrate the applicability of the law of the conservation of energy to the human organism.

Experiments on the Metabolism of Matter and Energy in the Human Body. BY W. O. ATWATER AND F. G. BENEDICT. *U. S. Dept. Agr., Expt. Sta., Bull.* 69, 1–112.—This bulletin contains detailed descriptions of six experiments made on the metabolism of matter and energy in human subjects by the use of a respiration calorimeter. Various improvements in the methods of sampling the food materials used and in the methods of examination of the waste materials are described. The accuracy of the apparatus and of the methods for the determination of carbon dioxide, water, and heat was tested with an electric current, by which known amounts of heat were produced in the chamber of the apparatus, and by burning alcohol in the chamber, thus producing known amounts of carbon dioxide, water, and heat.

The Influence of the Presence of Pure Metals upon Plants. BY EDWIN B. COPELAND AND LOUIS KAHLENBERG. *Trans. Wis. Acad. Sciences, Arts, and Letters*, 22, 454–474.—Nageli concluded from a study of this subject that pure water is harmless, but that various metals in infinitesimal quantities are deadly. He was convinced that the injury done to the plant was of a different nature from ordinary poisoning and proposed for the new phenomenon the name of "Oligodynamic effects." The

Digitized by Google

authors do not accept this explanation, but consider the result to be due to the presence of metallic salts formed by the action of the oxygen or the carbonic acid of the water or of the water itself. In studying this question, a number of experiments have been carried out in glass beakers coated with paraffin to remove the disturbing influence of the glass. The metals were used where possible, in the form of foil, in order to expose a large surface; the seedlings used were average plants selected from a large number. At the beginning of the experiment a mark was made 10 mm. from the apex of the root and the excess in length of these spaces over the original was noted daily. The condition of the metals was also observed at the end of the experiment. The injury to the plant was found to depend largely upon two factors; namely, on the tendency of the metal to go into solution as a chemical compound or salt, and on the specific toxicity of the metal when in solution in the form of such salts. In regard to the first factor, it was found that the relative power of those metals in causing injury was closely related to the magnitude of their solution tension; concerning the second, it was found that in general those metals poison plants when present in water whose salts are already known to be toxic.

On the Excretion of Kynurenic Acid. By LAFAYETTE B. MENDEL AND HOLMES C. JACKSON. *Am. J. Physiology*, 2, 1–28.—Kynurenic acid is, with only one exception, the only quinoline compound discovered in connection with the animal body. The object of the authors was to study the conditions which determine and modify the production and excretion of kynurenic acid. Experiments were made on dogs which were fed on definite quantities of food, the excreted nitrogen and kynurenic acid being determined by analysis. The results obtained indicate that kynurenic acid excretion accompanies accelerated proteid decomposition and is directly dependent on the proteid katabolism. Similar results are given by the ingestion of both animal and vegetable proteids as well as proteoses, but gelatin, like the carbohydrates, does not give rise to kynurenic acid in metabolism. Under the influence of foods lacking in protein the kynurenic acid excretion is greatly diminished or absent. Kynurenic acid has not been found in the urine of any animal other than the dog.

The Origin of Fibrinogen. By ALBERT MATHEWS. *Am. J. Physiology*, 3, 53–85.—It is shown by a number of experiments that after defibrination of the blood of cats the fibrinogen is rapidly re-formed, the amount becoming normal again in two or three days. This re-formation of the fibrinogen takes place in the absence of the spleen, pancreas, kidneys, reproductive organs or brain, but does not take place to any appreciable extent if the small and large

Digitized by Google

intestines be removed. The paraglobulin of the blood is not converted into fibrinogen outside the body nor by the skin or more remote tissues. The blood of the inferior vena cava both above and below the kidneys is poorer in fibrinogen than is the carotid blood, while the blood of the mesenteric vein is constantly somewhat richer in fibrinogen than is the arterial blood. Fibrinogen is not derived directly from the proteid constituents of food, since it is readily re-formed after six to ten days' fasting; the fibrinogen content of the blood does not diminish during fasting. If, however, leucocytosis be prolonged for several days the fibrinogen content of the blood increases. These various observations point to the decomposing leucocytes of the blood, and chiefly those of the intestinal area, as being the source of the fibrinogen of the blood, although it is hardly possible as yet to regard the evidence as conclusive.

On Metabolism during a Combination of Phosphorus Poisoning and Phlorhizon Diabetes. By W. E. Ray, T. S. McDermott, and Graham Lusk. *Am. J. Physiology*, 3, 139–155. —In dogs diabetic with phlorhizin phosphorus poisoning does not cause any noteworthy increase in proteid metabolism or change the sugar excretion; in dogs poisoned with phosphorus, however, the administration of phlorhizin brings about not only the usual preliminary sweeping out of the body sugars and the establishment of the customary ratio between urinary dextrose and nitrogen, but also causes an increase in proteid metabolism. The authors consider the high proteid decomposition in phlorhizin diabetes to be due to the non-burning of the carbohydrate-like radical of the proteid molecule. In phosphorus poisoning the proteid decomposition is due to the fatty degeneration of the carbohydrate radical. The fatty infiltration noticed in post-mortem examinations is due to the action of pathologically hungry cells which attract the fat to themselves in greater quantities than can be utilized.

A Preliminary Note on the Fractional Precipitation of the Globulin and Albumin of Normal Horse's Serum and Diphtheric Serum, and the Antitoxic Strength of the Precipitates. By James P. Atkinson. *J. Expt. Medicine*, 4, 649–650.—In this preliminary paper attention is called to the compounds obtained from the globulin of horse's serum by fractional precipitation with sodium chloride at temperatures between room temperature and 72° C. The same phenomenon is noticed in the serum itself after removal of the globulin, precipitation beginning at 56° C. and being complete at 81°. Each fraction of the antitoxic globulin is found to possess antitoxic power, while the final filtrate is free from antitoxin.

Digitized by Google

Observations on the Nitrogenous Metabolism of the Cat, Especially on the Excretion of Uric Acid and Allantoin. By LAFAYETTE B. MENDEL AND ERNEST W. BROWN. *Am. J. Physiology*, 3, 261–270.—The results of a number of experiments show that kynurenic acid is not excreted by the cat, even under conditions of increased proteid metabolism. An increase, however, in the excretion of uric acid is brought about by feeding the animals with thymus and pancreas tissue, as is also the case with man and with the dog. The excretion of allantoin is noticeable after the ingestion of thymus and pancreas tissue or uric acid, but preliminary experiments have failed to show the production of allantoin after the administration of hydrazine sulphate.

On the Occurrence of Iodine in the Thymus and Thyroid Glands. By LAFAYETTE B. MENDEL. *Am. J. Physiology*, 3, 285–290.—The author concludes that there is no evidence to show that the carefully isolated thymus of man or animals contains iodine, and considers the traces found by other observers to be due to adherent thyroidal tissue. The results of several observations present confirmatory evidence of the absence of iodine in the thyroid glands of newly-born children. The accessory thyroids in man sometimes contain more iodine than the thyroids proper.

On the Chemical Reaction of the Intestinal Contents to Various Indicators, and on the Nature of the Contents Escaping from a Fistula Immediately above the Ileo-caecal Valve. By B. MOORE AND T. J. BERGIN. *Am. J. Physiology*, 3, 316–325.—The alkaline reaction of the intestine to methyl orange, lacmoid, and litmus, shows the absence of hydrochloric acid, and of all stronger organic acids as acetic, lactic, or butyric, which would be formed in the bacterial decomposition of carbohydrates or fats. The acid reaction of the intestine to phenolphthalein the authors consider due to the excess of dissolved carbonic acid. The chemical nature of the substance escaping from the fistula indicates that the absorption of foodstuffs, in the dog at least, can be practically completed in the small intestine. A proteolytic enzyme, active in alkaline solution, and a diastatic ferment, also active in alkaline solution, are found in the dog's intestine at this level.

E. H. RICHARDS, REVIEWER.

Rivers Pollution and Water Supplies. By HERBERT E. SMITH. *Conn. State Board of Health, Ann. Rep., 1898*, 266–395.—The water supplies of twenty towns in the state have been examined monthly for periods varying from three months to one year. The Naugatuck and Quinnipiac rivers have been exam-

Digitized by Google

ined during one year at four places each. The results add valuable data for New England water-sheds. There are also given the results of a year's examination of the sewage and effluent from Meriden.

An Investigation of the Action of Water upon Lead, Tin, and Zinc. By H. W. Clark. *Mass. State Board of Health, Ann. Rep.*, 30, 541–585.—Eight hundred samples of water from 63 towns in the state were examined. The water from 24 towns showed less than 0.05 parts of lead per 100,000; from 29 towns there was over 0.1 part, and of these 10 samples gave from 0.40 to 8.55, results quite justifying the extensive examination. The method finally used is as follows: 3.5 liters are concentrated to 25–30 cc., ammonium chloride and ammonia are added, and then hydrogen sulphide water. After standing, the hydrogen sulphide is expelled by boiling, and the separated sulphides of iron, lead, copper, and zinc, together with any suspended organic matter, are filtered off, the soluble coloring-matter remaining in the filtrate. The residue is heated with HNO_3 (1 part acid, sp. gr. 1.2, to 5 parts water), the solution filtered, concentrated to 10–15 cc., treated with 5 cc. strong H_2SO_4, and heated until fumes of the latter come off. If the sample contained less than 0.025 part per 100,000 of iron, it is removed by ammonia and the lead determined in the filtrate. If, however, there is a larger amount, the lead sulphate is washed with 50 per cent. alcohol until free from iron, and then dissolved in ammonium acetate and the depth of color, given by freshly prepared hydrogen sulphide, compared with that of standards. Copper rarely interferes, and zinc is easily separated and determined.

Report on the Investigations into the Purification of the Ohio River Water at Cincinnati. By George W. Fuller. *Cincinnati, 1899*, 1–620.—In addition to many valuable data on water purification from the mechanical and bacteriological point of view, this report contains the results of daily examinations of the Ohio River water over a period of two months, as compared with the averages of the previous year, and also analyses of the various effluents. There is, in addition, an account of experiments with lime as a coagulant for suspended clay, combined with subsequent treatment by carbon dioxide to remove the excess of lime.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. NO. 3.

ARTHUR A. NOYES, Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

The Rate of Action of Water on Certain α,- β,- and γ-Halogen Substituted Fatty Acids. BY EDWIN DEBARR. *Am. Chem. J.*, **22**, 333–351.—In order to determine the influence of the position of the halogen atom on the decomposition of substituted fatty acids by water, a number of acids were heated with water in sealed tubes at 150°, as it was found that the reaction could be most readily studied under these conditions. The figures given in the following table are selected from the large number obtained. In the first column are given the percentages of transformation of the respective acids at the end of one-half hour. The second column gives the time in hours when transformation ceased, and the third column the total amount changed in this time:

Acid.	I.	II.	III.
Monochloracetic	4.06	30	47.11
Dichloracetic	5.32	5	17.76
Trichloracetic	42.38	8	100.00
α-Chlorpropionic	4.42	3	11.41
α-Brompropionic	2.93	2	7.06
α-Brombutyric	3.77	3	9.25
α-Chlorbutyric	5.80	3	7.50
β-Chlorpropionic	41.50	4	50.44
β-Chlorbutyric	29.97	3	37.38
γ-Chlorbutyric	100.00	$\frac{1}{12}$	100.00

The order in which decomposition takes place is, excepting in the case of mono-, di-, and trichloracetic acid, not the same as is that of the affinity constants of the acids. The order of the stability of the compounds is, however, the same as that of the

Digitized by Google

affinity. The influence of the distance of the halogen from the carboxyl group is clearly shown with the butyric acids, the rate of transformation rapidly increasing the further the halogen atom is removed from the carboxyl group. Care was taken to obtain the acids necessary for the investigation in a state of purity. As a result the physical constants determined are more trustworthy than those heretofore obtained. β-Chlorpropionic acid melts at 61° and boils at 204°. β-Chlorbutyric acid melts at 16°–16.5° and boils at 116° at 22 mm. pressure. γ-Chlorbutyric acid boils at 196° (22 mm.) and melts at 12°.

On the Nature of the Oxyazo Compounds. By William McPherson. *Am. Chem. J.*, **22**, 364–384.—From the work of previous investigators to determine the nature of the oxyazo compounds, it has been impossible to decide which of the following formulæ expresses the structure of these compounds: HO.R.N: N.C_6H_5, O.R: N—NH.C_6H_5. The author has obtained decisive evidence by studying the action of unsymmetrical alkylated and acylated derivatives of phenylhydrazine on ortho and para quinones. The condensation-products thus obtained, O.R: N—N.R'.C_6H_5, were compared with the free oxyazo compounds and the corresponding products obtained from these by direct alkylation and acylation. The results prove that all paraoxyazo compounds, as well as their salts and substitution-products, possess the general formula MO.R.N: N.C_6H_5 (M=H, a metal, acyl, or alkyl). The work in the ortho series, while not so decisive, points to the conclusion that these compounds and their acylated derivatives are monohydrazones of orthodiketones, O.R: N—N.M.C_6H_5 (M=H or acyl). The alkylated substitution-products, on the other hand, are azo compounds, R'O.R.N: N.C_6H_5. Quinonebenzoylphenylhydrazone was prepared by mixing aqueous solutions of quinone and α-benzoylphenylhydrazine hydrochloride. The yellow precipitate formed melted at 171° after crystallization from benzene. The compound, when reduced with zinc and acetic acid, was split quantitatively into benzanilide and p-amidophenol. It was converted by acids and alkalies into benzoic acid and p-oxyazobenzene. The hydrazone which, from its method of synthesis and its properties, must have the structure represented by the formula O: C_6H_4: N.N.C_6H_5.COC_6H_5 is isomeric, not identical, with the compound formed by introducing the benzoyl group into p-oxyazobenzene. This latter substance must have, therefore, the structure $C_6H_5CO.O.C_6H_4.N$: NC_6H_5. From the following facts the conclusion is drawn that p-oxyazobenzene is a true azo compound: (1) In the derivatives formed by the introduction of acyl or alkyl groups these groups are joined to oxygen. (2) It has been shown by Goldschmidt and others that o-oxyazo derivatives

Digitized by Google

by direct acylation yield compounds which contain the acyl group joined to nitrogen. (3) Free *p*-oxyazo compounds do not react with phenylhydrazine, whereas all *p*-quinonebenzoylphenylhydrazine derivatives, like benzoquinone itself, react with this reagent with explosive violence. (4) The *p*-oxyazo compounds are soluble in dilute alkalies. The *o*-oxyazo compounds of the naphthalene series, however, are not affected by even concentrated caustic alkalies. (5) The study of the physical properties of the *p*-oxyazo compounds leads to results in accord with those obtained by chemical methods. The acetate of *p*-oxyazobenzene must have the structure $C_6H_5.N : N.C_6H_4O.CO.CH_3$, since it is not identical with quinoneacetylphenylhydrazone (m. p. 118°) made by the action of *α*-acetylphenylhydrazine on quinone. The following hydrazones were prepared and compared with the corresponding derivative of the oxyazo compounds with analogous results: Toluquinonebenzoylphenylhydrazone (m. p. 151°), thymoquinonebenzoylphenylhydrazone (m. p. 132°), *α*-naphthoquinonebenzoylphenylhydrazone (m. p. 161.5°). When benzoquinone and *α*-methylphenylhydrazine hydrochloride were brought together in dilute aqueous solution, an evolution of nitrogen took place and dimethyldiphenyltetrazone (m. p. 133°) separated. From *α*-benzylphenylhydrazine an analogous benzyl derivative (m. p. 145°) was prepared. When *α*-naphthoquinone was used, however, a hydrazone was formed similar in structure to the compounds prepared from the acylated hydrazines. The methyl derivative melts at 118.5° and the benzyl derivative at 136°. The benzyl ether of benzene azo-*α*-naphthol (m. p. 102°), which is isomeric with the latter compound, was prepared from the azo compound and benzyl chloride. When an orthoquinone was studied the results obtained were different from those described alone. The compound formed by treating *β*-naphthoquinonehydrazone with benzoyl chloride was found to be identical with the hydrazone prepared by the action of *α*-benzoylphenylhydrazine on *β*-naphthoquinone. The compound, which must contain the benzoyl group joined to nitrogen, crystallizes from benzene-ligroin and melts at 191°. When the methyl ethers were made, however, two compounds were obtained, an azo body (m. p. 95°) and a quinonehydrazone (m. p. 134.5°).

The Action of Benzoyl Chloride on the Phenylhydrazones of Benzoin. By Paul C. Freer. *Am. Chem. J.*, **22**, 396–402.—In a previous paper (*this Rev.*, **5**, 32; see also *this Rev.*, **5**, 125) the author described a compound formed by the action of benzoyl chloride on *β*-benzoinphenylhydrazone. From an analysis and a molecular weight determination of the substance, it appeared that the chloride had simply effected a molecular rearrangement

Digitized by Google

and that the compound was a third phenylhydrazone of benzoin. The reaction has been investigated further and the reaction-product described found to be benzanilide. The reaction is a complex one, as the following substances were isolated in addition to benzanilide: benzil, lophine, dibenzanilide, hydrochloric acid, ammonium chloride, aniline hydrochloride, and a large amount of tar. When nitrobenzoyl chloride was used no lophine was formed. The probable course of the reaction by which the above-mentioned compounds are formed is fully explained. Nitrobenzoyl chloride reacts readily with both α- and β-benzoinphenylhydrazone, whereas benzoyl chloride does not react with the α-variety at winter temperature.

Notes on the Space Isomerism of the Toluquinoneoxime Ethers. By WILLIAM CONGER MORGAN. *Am. Chem. J.*, **22**, 402–407.—In a former paper (*this Rev.*, 5, 30) it was stated that certain ethers of toluquinonemetaoxime, whether formed by the action of hydroxylamine on the quinone or by nitrous acid on the corresponding cresol, showed evidence of existing in isomeric forms. By fractional crystallization of the benzoyl ester two substances have been obtained, one melting at 193° and one melting approximately at 144°. The low-melting compound, which was not obtained in a state of purity, is changed slowly into the high-melting form by repeated crystallizations from alcohol. When heated at 120° with alcohol the change is rapid and complete. The formation of isomers has been noted in the case of ethers prepared from acid chlorides and the sodium salt of the oxime made by the action of amyl nitrite on the sodium salt of the cresol. Under these circumstances the chance of the formation of side-products which would effect the purity of the ether is small, and, consequently, the results obtained indicate that the isomerism is due to the space relation of the atoms. The following-named substances are described: The sodium salt of toluquinone-*m*-oxime, bromtoluquinone-*o*-oxime benzoyl ether (m. p. 184°), toluquinone-*o*-oxime benzoyl ether dichloride (m. p. 149°), chlortoluquinone-*o*-oxime benzoyl ether (m. p. 185–193° with decomposition).

On the Constitution of α-Dibromdinitrobenzol—Paradibrom-orthodinitrobenzol. By D. F. CALHANE AND P. M. WHEELER. *Am. Chem. J.*, **22**, 449–458.—When *p*-dibrombenzene is treated with a mixture of fuming nitric acid and sulphuric acid, the resulting product consists chiefly of β-dibromdinitrobenzene

$$(Br1, NO_2 2, Br4, NO_2 6)$$

and a small quantity of α-dibromdinitrobenzene. The authors show that the structure of the latter compound is represented by the formula $C_6H_2Br_2NO_2(Br1, 2NO_2 2, 3, Br4)$. This fact was estab-

Digitized by Google

lished by converting the compound into a dibromphenylenediamine (m. p. 94°–95°) from which *o*-phenylenediamine was obtained by prolonged treatment with sodium amalgam. This result was confirmed by treating the *p*-dibromphenylenediamine with phenanthrenequinone, which gave a dibromphenanthrophenazine (m. p. 297°), and also by treating the diamine with benzil, when dibromdiphenylchinoxaline (m. p. 215°–216°) was formed. As such compounds are formed only from *o*-diamines the structure of *α*-dibromdinitrobenzene was established since it was prepared from *p*-dibrombenzene.

Phenyl Mustard Oil as a Reagent for the Detection of the Alcoholic Hydroxyl Group. By W. R. Orndorff and F. A. Richmond. *Am. Chem. J.*, **22**, 458–473.—The action of phenyl mustard oil on a large number of compounds was studied, in order to discover if it exhibited the marked chemical reactivity which is characteristic of phenyl isocyanate. Its use as a reagent for the detection of the hydroxyl group is limited. It reacts to form well-crystallized compounds with primary, secondary, and tertiary alcohols, but it does not combine with unsaturated alcohols, acids, phenols, or alcohols of the benzene series. The addition-products of phenyl mustard oil and the following alcohols are carefully described: methyl, ethyl, propyl, isopropyl, isobutyl, tertiary butyl, and isoamyl alcohol. When phenyl mustard oil was heated with allyl alcohol, diphenyl urea was formed, and when glycol and glycerine were used, the chief reaction-product was thiocarbanilide. By the action of phenol on phenyl mustard oil thiocarbanilide was formed, and not the phenyl ester of thiocarbamic acid which, according to the literature, is the product of this reaction.

The Ethers of Isonitrosoguiacol in Their Relation to the Space Isomerism of Nitrogen. By John L. Bridge and William Conger Morgan. *Am. Chem. J.*, **22**, 484–489.—Since the authors have noted the existence of stereoisomerism in the case of certain quinoneoximes, it seemed advisable to repeat the work of previous investigators on isonitrosoguiacol in order to discover if isomerism exists in the derivatives of this compound. A study of the compounds already described, in addition to the benzoyl ether isonitrosoguiacol (m. p. 188° when "dipped" for ten seconds) and its dibromide (m. p. 153°–154°) and monobromisonitrosoguiacol benzoyl ether led to the discovery of no case of stereoisomerism.

Diazocaffeine. By M. Gomberg. *Am. Chem. J.*, **23**, 51–70.—When amidocaffeine is dissolved in strong hydrochloric acid and treated with nitrous acid, a diazo compound is formed, which is stable only in solution at a low temperature. Diazo-

Digitized by Google

caffeine reacts with aromatic phenols and amines with the formation of azo compounds, which crystallize well and possess intense dyeing power. The azo dyes prepared from phenol, dimethylaniline, phenylenediamine, and β-naphthol are described in detail. That the caffeine molecule is not broken up by the action of nitrous acid, but that a true diazo salt of caffeine is formed was shown in two ways. First, when caffeine instead of its amido derivative was subjected to the same treatment with nitrous acid, it remained entirely unchanged; and second, the azo dyes on treatment with stannous chloride furnished almost quantitatively amidocaffeine and the corresponding aromatic body. The condensation-product of acetoacetic acid and diazocaffeine is not similar in structure to the compound found under like conditions with aromatic diazo salts. The caffeine derivative is a diazo compound, $CH_3COC.(N_2.C_8H_9N_4O_2)_2.COOH$, whereas diazo benzene chloride and acetoacetic ester give a hydrazo and a formazyl compound. Propyl and benzylacetoacetic acids give analogous compounds, the introduction of two diazo residues being made possible by the elimination of the acetyl group as acetic acid. The condensation-products,

$$R.C(N_2C_8H_9N_4O_2)_2COOH,$$

were obtained as dark crystalline powders which could be heated to 285° without melting and without decomposition. Diazocaffeine and nitroethane react readily with the formation of a substance of the structure $NO_2C.CH_2.(N_2C_8H_9N_4O_2)_2$. The compound crystallizes from a mixture of chloroform and ether in deep-blue flakes, melts at 218°–219°, and shows marked changes in color when heated with water. Nitropropane forms an analogous compound (m. p. 237°–238°).

The Action of Ethyl Iodide on Tartaric Ester and Sodium Ethylate. By John E. Bucher. *Am. Chem. J.*, 23, 70–83.—Previous investigators have found it impossible to prepare symmetrical diethoxysuccinic ester by the usual synthetical methods. Neither the mono- nor disodium derivative of tartaric ester reacts with methyl or ethyl iodide, and symmetrical dibromsuccinic ester gives unsymmetrical esters when treated with alkyl halides. The author studied carefully the action of ethyl iodide on tartaric ester in the presence of sodium ethylate, and found among the products of the reaction three forms of diethoxysuccinic ester; *viz.*, the unsymmetrical and inactive and *d*-symmetrical varieties. Some of the monoethoxy derivative was also present. The proportions of the different substances varied as the proportions of the reacting substances were changed. The diethoxy derivatives were separated by saponifying the esters and adding calcium chloride when the calcium salt of unsym-

Digitized by Google

metrical diethoxysuccinic acid was precipitated. The symmetrical acid, obtained by extracting the acidified filtrate with ether, melts at 97°–99° and forms very soluble crystalline potassium and barium salts. Hydroxyethoxysuccinic acid was isolated by precipitating its lead salt. The probable course of the reaction which results in the formation of an unsymmetrical derivative from a symmetrical compound is explained by the author. Preliminary experiments indicate the formation of oxalacetic ester as an intermediate product in the reaction.

Action of Picryl Chloride on Pyrocatechin in Presence of Alkalies. By H. W. Hillyer. *Am. Chem. J.*, **23**, 125–128.—A compound, the constitution of which is represented by the formula, $C_6H_4\begin{smallmatrix}O\\O\end{smallmatrix}C_6H_2(NO_2)_2$, is readily formed when an alcoholic solution of picryl chloride and pyrocatechin containing sodium hydroxide is heated at 60°–70° for six hours. The author proposes to name the substance of which the above compound is a dinitro derivative, phenoxozone, on account of its analogy to phenoxazine, which is made in a similar way from picryl chloride and *o*-amidophenol, and possesses the structure $C_6H_4\begin{smallmatrix}NH\\O\end{smallmatrix}C_6H_2(NO_2)_2$. Dinitrophenoxozone crystallizes from benzene, melts at 192°–192.5°, and sublimes unchanged in the form of yellow needles.

Nitroso Derivatives of Caryophyllene and Cadinene and Their Bearing on the Characterization and Classification of the Sesquiterpenes. By Oswald Schreimer and Edward Kremers. *Pharm. Archives*, **2**, 273–301.—A number of derivatives of caryophyllene and cadinene were prepared and carefully studied. As the substances have well-characterized physical properties they will materially assist in the study of the above compounds as well as in the investigation of other sesquiterpenes. Caryophyllene nitrosite crystallizes in deep-blue needles, melts at 113°, and has the rotation $[\alpha]_D = +102.95$ in benzene solution. It reacts with benzylamine, forming a white crystalline compound, which melts at 167°. When exposed to the sunlight in benzene solution about 29 per cent. of the nitrogen is liberated and the β-compound is formed (m. p. 146°–148°). In alcoholic solution a similar reaction takes place and a third isomer, the α-compound, is formed. It melts at 113°–114°, and is either slightly dextrogyrate or inactive. By a new method of preparation a good yield of caryophyllene nitrosochloride (m. p. 158°) was obtained. The nitrosochloride and benzylamine react

Digitized by Google

readily with the formation of two nitrolbenzylamine bases (m. p. 128° and 169°). The nitrosate of the terpene melts at 148°–149° and forms with benzylamine a nitrol base (m. p. 128°), which is identical with the one obtained from the nitrosochloride. Contrary to the statement in the literature, the authors were able to prepare a crystalline hydrochloride of caryophyllene (m. p. 69°–70°). Cadinene forms a nitrosate, which melts with decomposition at 105°–110°, and a nitrosochloride which melts at 93°–94°.

A Preliminary Communication upon Ricinine. By Thomas Evans. *J. Am. Chem. Soc.*, **22**, 39–46.—The author shows that the substance obtained by Tuson by extracting castor beans with boiling water, to which the name ricinine was given, is identical with ricidine, which was isolated by Schulze from the same source by a different method of extraction. The compound crystallizes in small colorless prisms, melts at 193°, and gives results on analysis agreeing closely with the formulæ $C_{16}H_{16}N_4O_4$ and $C_{16}H_{18}N_4O_4$. The formation of a chlorplatinate, described by Tuson, was probably due to the presence of an impurity in the ricinine investigated, since the pure compound does not form such a salt. It does not give a precipitate with silver nitrate, mercuric nitrate, or mercuric chloride, but on long standing a concentrated solution of ricinine and mercuric chloride yield a feathery crystalline product. By brominating ricinine a substitution-product (m. p. 232°) containing two bromine atoms was obtained. On oxidation with alkaline potassium permanganate a crystalline acid, which melted at 279°–280°, was obtained.

Benzenestearosulphonic Acid and Other Sulphonic Acids Containing the Stearic Radical. By E. Twitchell. *J. Am. Chem. Soc.*, **22**, 22–26.—Benzenestearosulphonic acid, $C_6H_4.SO_3H.C_{18}H_{33}O_2$, was prepared by treating a mixture of oleic acid and benzene with concentrated sulphuric acid. The acid is a sticky, semisolid mass, soluble in water, and forms alkaline salts which are readily precipitated by acids, bases, or salts. Analogous compounds were prepared from naphthalene and phenol.

METALLURGICAL CHEMISTRY.

H. O. Hofman, Reviewer.

The Ultimate and Rational Analysis of Clays and Their Relative Advantages. By H. Ries. *Trans. Am. Inst. Min. Eng.*, **28**, 160–166.—The rational analysis of a clay which in its simplest form gives the three mineral constituents, kaolinite, feldspar, and quartz, consists in decomposing and dissolving the

Digitized by Google

kaolinite with sulphuric acid followed by caustic soda, weighing the residual feldspar and quartz, determining the alumina in it, and then calculating the feldspar. Its value, especially with fire clays containing a small percentage of fluxing impurities (iron, lime, and magnesia) lies in the fact that it gives much information as to the behavior of a clay in shrinking and melting, which the ultimate analysis does not give.

A Modification of Bischof's method for Determining the Fusibility of Clay, as Applied to Non-refractory Clays, and the Resistance of Fire-clays to Fluxes. By H. O. Hofman. *Trans. Am. Inst. Min. Eng.*, **28**, 435–440.—There are two leading methods of testing clays, the direct one of Seger and the indirect one of Bischof. In the former, a clay to be tested is compared with the standard series of Seger; in the latter a clay is toned up with a silica-alumina mixture until it shows in the fire the same behavior as the most refractory clay known, that of Saarau. Instead of the Saarau clay the author chose the Seger cone No. 26, which forms the line of separation between refractory and non-refractory clays. He toned up a number of non-refractory clays until they behaved in the fire in the same manner as did the Seger cone No. 26, and tested the resistance of fire-clays to fluxes by mixing weighed samples of 1.5 grams severally with increasing amounts of fluxes until they yielded to the heat at which the sample cone bent over. By this modification of Bischof's method two things can be accomplished, the finding out, first, how much high-grade material is to be added to one of an inferior character to bring it up to a certain standard, and, second, how the resistance of acid or neutral materials to the corroding influences of bases, or vice-versa, can be determined.

Does the Size of Particles Have Any Influence in Determining the Resistance of Fire-clays to Heat and Fluxes. By H. O. Hofman and B. Stoughton. *Trans. Am. Inst. Min. Eng.*, **28**, 440–444.—In testing fire-clays and fire-brick in the laboratory, the first step is to grind them to an impalpable powder. The objection made to this procedure is that the behavior of a brick which is a mixture of coarse and fine material in the fire must be different from that of the same material when finely ground. The experiments made with the material just as it is going to be used in making the brick and after fine grinding, prove that in the laboratory practically the same results are obtained with respect to resistance to heat as well as to fluxes, whether the material used be finely ground or not.

Digitized by Google

Testing Lead-tin and Lead-antimony Alloys. By J. Richards. *J. Franklin Inst.*, 147, 398–400; *Iron Age*, 63, 12.—The author prepared alloys of lead with 1–24 per cent. antimony, the largest amount that will alloy with lead, cast them into bullets to be used as standards for determining by direct weight the percentage of antimony in hard lead, cast in the same mold into bullets. The anomalous fact that 2 per cent. or less antimony makes the lead-antimony alloy heavier than pure lead, was corrected by preparing a separate set of bullets of lead with 2 per cent. antimony down to pure lead, the amount in each bullet diminishing by 0.1 per cent. These bullets have a frosty appearance and are therefore readily distinguished from the others. The author prepared a similar series of lead-tin alloys in which the tin diminishes by 0.1 per cent.

A Furnace for Smelting Zincose Lead Ores. By L. Kloz. *Eng. Min. J.*, 68, 279–280.—The peculiarities of this furnace are that the shaft and boshes consist of cast-iron plates in which water circulates through wrought-iron pipes and that the crucible, made of cast-iron plates, is detached, being brought beneath the furnace on a truck and raised into position by jack-screws.

Notes on Silver Losses in Smelting. By M. W. Iles. *Eng. Min. J.*, 68, 307–309, 340–341, 367–369.—This paper is replete with data from the author's experiments as metallurgist of the Globe Smelting and Refining Co., Denver, Colorado.

Notes on Lead Smelting and Gold and Silver Refining—Slag Settling Furnaces. By M. W. Iles. *Eng. Min. J.*, 68, 667–669, 729.—The paper discusses briefly the apparatus used for separating lead-matte from slag outside of the blast-furnace, and gives some facts relating to the reverberatory settling furnace patented by the author, and also several complete analyses of fumes collected by filtering devices.

Potash and Soda Salts from Natural Decomposition of Lead Slags. By M. W. Iles and C. F. Shelby. *Eng. Min. J.*, 67, 650.—At or near the bottom of the slag-heap of the works of the Globe Smelting and Refining Co., at Denver, the authors found a white, efflorescent salt which was formed by the decomposition of the slag through atmospheric agencies. The ultimate analysis gave: SO_3, 48.45; K_2O, 28.44; Na_2O, 13.48; CaO, 1.80; MgO, 0.80; Fe_2O_3, 0.29; MnO, 0.26; Cl, 0.47; loss on ignition, 2.40; total, 96.97. These results show that the bases were combined mainly with sulphuric acid, which had been formed by the oxidation of the sulphides held in igneous solution by the slag.

Digitized by Google

Potash and Soda Salts in Lead Slags. By R. C. Canby. *Eng. Min. J.*, **68**, 3.—Referring to the preceding paper the author notes the formation of similar potash and soda salts on heaps of some copper matte after exposure to snow, followed by bright, warm sunshine.

Notes on Lead Smelting and Gold and Silver Refining—Fans for Handling Lead Fume. By M. W. Iles. *Eng. Min. J.*, **68**, 788–789.—The larger part of this paper deals with the details of construction of the fans used at the silver-lead works of the Globe Smelting and Refining Co., at Denver. Here the dust-laden gases from the blast-furnace, the zinc retorts, and the silver-melting furnaces, are drawn off by fans and forced through cotton filter-bags.

A Liquid from the Fume of Lead Furnaces. By M. W. Iles. *Eng. Min. J.*, **68**, 576.—The author collected at the works of the Globe Smelting and Refining Co., at Denver, yellow icicles which had formed on a very cold day at the extreme end of the flue which carries the blast-furnace gases and dust into the filtering department. They showed, after dissolving in water, the following composition in grams per liter: $FeSO_4$, 88.40; $MnSO_4$, 0.68; $ZnSO_4$, 24.56; As_2O_3, 1.45; NaCl, 7.26; Na_2SO_4, 3.69; K_2SO_4, 2.22; $(NH_4)_2SO_4$, 33.00; H_2SO_4, 1.22; H_2SO_3, 15.00; organic matter, 31.94; total, 209.42.

Ammonia in Flue-dust. By R. C. Canby. *Eng. Min. J.*, **68**, 633.—The author's attention was called to the presence of ammonia in flue-dust from blast-furnaces, when mixed with milk of lime previous to bricking.

Blakemore's Results in Refining Lead by Parkes' Process. By W. Jones. *Eng. Min. J.*, **68**, 273.—Blakemore found that the drosses obtained in the softening furnace and the desilverizing kettle from base bullion rich in gold and copper, were heavy and contained large amounts of gold. The author advocates the method, common in American refineries, of matting the dross in the softening furnace (see Hofman, "Lead," 5th edition, page 435) which leaves nearly all the gold in the lead where it belongs, and greatly reduces the amount of intermediary product requiring retreatment. The author also states that he found little difficulty in separating gold from silver by zincking with base bullion that contained three times as much gold as silver.

Refining Products. By M. W. Iles. *School Mines Quart.*, 20, 397.—This paper is mainly a table containing forty-eight analyses and assays by H. Alexander of products from the desilverization of base bullion by the Parkes process, at the works of the Globe Smelting and Refining Co., at Denver, Colo.

Digitized by Google

Silicon and Copper Silicide. By O. J. Steinhart. *Eng. Min. J.*, 67, 710.—The paper briefly points out the uses to which silicon and copper silicide made by the Cowles Electric Smelting and Aluminum Co., at Lockport, N. Y., can be put. In making iron castings, silicon can take the place of silvery irons; in steel castings low in carbon it does away with the use of ferro-silicon or ferromanganese, which increases the carbon content. Silicon-copper with 10, 15, and 30–35 per cent. silicon is sold in the form of ingots having notches; they weigh 15–18 pounds. It can be used instead of phosphide of copper to promote the soundness of copper and of bronze castings. Small quantities of silicon, up to 0.1 per cent., make the copper stronger than pure copper without materially reducing its electrical conductivity. The following table gives some interesting facts bearing on this matter:

Per cent. silicon.	Tensile strength. Lbs. per square inch.	Electrical conductivity.
None (pure copper wire)	39,825–49,780	100
0.02–0.05	64,000	98
0.05–1.1 (with 1.10 Sn)	118,000	43
0.50	71,116	28
3.5	135,120	7

The Influence of Antimony on the Cold-shortness of Brass. By E. S. Sperry. *Trans. Am. Inst. Min. Eng.*, 28, 176–190.—As a basis for the experiments, the author chose a high brass containing 60 per cent. copper and 40 per cent. zinc, which would roll both cold and hot, and added varying amounts of antimony in the form of copper-antimony alloy. The molten material was poured into a mould $\frac{5}{8} \times 2\frac{3}{8} \times 24$ inches with the necessary precautions; the plate was cleaned by scraping and then rolled. The experiments showed that brass should not contain over 0.01 per cent. antimony if it is to roll satisfactorily.

The Influence of Bismuth on Brass and Its Relation to Fire-cracks. By E. S. Sperry. *Trans. Am. Inst. Min. Eng.*, 28, 427–435.—It is usually believed that bismuth is more deleterious even than antimony in casting brass. For the experiments a high brass of 60 per cent. copper and 40 per cent. zinc was chosen, and varying percentages (0.50, 0.25, 0.09, 0.05, 0.02) of bismuth were added, the alloys were cast into an iron mould to an ingot $\frac{5}{8} \times 2\frac{3}{8} \times 24$ inches and rolled when cold. The conclusions arrived at are that bismuth renders brass cold-short as well as hot-short, and is the cause of fire-cracks. High brass to be cold-rolled should not contain over 0.01 per cent. bismuth.

A New Form of Ingot Mould for Casting Brass or Bronze Ingots, with Remarks on the General Form of Ingots. By E. S. Sperry. *Trans. Am. Inst. Min. Eng.*, 28, 246–253.—The

Digitized by Google

author illustrates a mould made of soft gray iron weighing about 35 pounds which he found suitable for casting ingots weighing 15–25 pounds, also tongs suited both for dumping the mould and handling the ingot while hot.

Reducing-Roasting.—Its Value for Arsenic—Expulsion from Copper Ores and Mattes. By E. W. Scherr. *School Mines Quart.*, **21**, 66–74.—The paper gives the results obtained by an oxidizing followed by a reducing roast of a mixture of arsenopyrite and a copper matte (Cu, 50.16 per cent.; Ag, 16.82 ozs.; Au, 0.18 ozs.), averaging 4.56 per cent. As. The furnace was an 18 × 24 inch American Gas Co. annealing furnace. Two lots of $3\frac{3}{4}$ kilos were brought in $4\frac{3}{4}$ hours approximately to a dead-roast in shallow iron trays, 7 × 23 inches; 10 per cent. of finely pulverized charcoal was added to one of them, and the roast continued for 1 hour and 55 minutes, when all the carbon was consumed. The temperature at the beginning, 460° C., was slowly raised to the end, when it reached 767° C. The tabulated and plotted results show that during the first two hours the arsenic had been reduced to 0.8 and 0.9 per cent., and $2\frac{3}{4}$ hours later to 0.7 per cent., when charcoal was added to one lot, while at the end of the roast both samples retained 0.5–0.6 per cent. arsenic. Copper began to be converted into sulphate one hour after starting; after 3 hours 5 per cent. was rendered soluble, the percentage of sulphate then diminished in one lot to 3 per cent.; as soon as charcoal was added to the other lot (5 hours after starting) the sulphate was quickly decomposed, leaving only 0.2 per cent. soluble copper. The author believes that during the first period arsenic was eliminated mainly as arsenious oxide, and to some extent as disulphide. The arsenious oxide was formed by oxidation of arsenide and by the reduction of arsenic oxide by sulphur, sulphur dioxide, and ferrous oxide, having been separated from its base by sulphur trioxide present in excess. The arsenic remaining in the ore is believed to be in combination with copper as arsenate, in which form it is decomposed with great difficulty by a reducing roast.

Roasting Copper Ores at Keswick, California. By Th. Neilson. *Eng. Min. J.*, **68**, 457.—The paper gives interesting data about roasting sulphide copper ores in heaps, stalls, and the Ropp and McDougal mechanical furnaces. The ore averages: Fe, 38; Cu, 8; Zn, 4; S, 46; SO_3, (?) and Al_2O_3, 3 per cent.; Ag, 1.5 ozs.; and Au, 0.03 ozs. per ton. Stalls 14 × 7 feet and 6 feet high, 170 in number, with a capacity of 6,000 tons of ore, were first used, but were replaced by heaps as the matting of the ore and the expense of discharging made the work too costly. The ore coming from the mine is charged into breakers with a grizzly with 3-inch spaces and a screen with $\frac{3}{4}$–1 inch

Digitized by Google

openings, thus furnishing coarse, medium, and small-size ore, which is collected in separate bins. From these it is run on a trestle, with bents 15 feet apart, over the roast-yard, where the heaps 20 feet wide, 8 feet high, and, varying with the nature of the ground, from 500–1,500 feet long, are erected. Fines are spread to a depth of 6–12 inches, then follows the bed of dry free-burning light wood (pine, fir, cedar, manzanita) 6 inches square in four-foot lengths. Longitudinal flues 4 inches wide, and, at eight-foot intervals, similar cross flues, are left open to be fired with kindling. At their intersections chimneys 8½ feet high are erected of old boards or of cord wood, and are filled with kindling. The fines are covered with cord-wood, and small wood is piled around the intersections of the flues. Coarse ore is now dumped onto the bed, and a wall six inches high of lump ore, or waste rock, is built outside of the wood, with arches over the flues. Coarse and medium ore follow, until the heap has nearly reached its normal height; it is followed by a cover of medium ore and then by one of fine ore about two inches in thickness. The heap being erected, the stringers (6 × 8 inches and 16 feet long), ties (4 × 4 inches), and rails (16–20 feet long), are removed to be used for another heap, while the poles (4–6 inches in diameter) are left, as the cost of recovering them is too great. The heap is fired by igniting one-half pint of coal oil poured into each of the chimneys. In one hour after starting the ore begins to burn. A heap burns about six months, reducing the sulphur to 12 per cent., of which 2 per cent. is present as sulphate. One cord of wood is sufficient for 120–150 tons of ore. When roasted, the ore is loaded by means of a ¾-yard steam shovel into cars and goes to the blast-furnace. Drilling holes 10 feet apart under the heap and blasting loosens up the roasted ore and helps the work of the steam-shovel. Building the heaps as described costs 17.9 cents per ton; but this has been reduced to 9.31 cents by doing the screening at the mine. Discharging the heap by hand costs 23 cents, by steam shovel 4.92 cents per ton. The two McDougal furnaces, 15 and 18 feet in diameter, roast 20 and 35 tons of fines (under one-half inch size) in 24 hours at a cost of 12–15 cents per ton for labor, at $1.85 per 10 hours. To the labor cost in the Ropp furnace, which is about the same as in the McDougal, 30 cents has to be added for cord-wood at $3.00 per cord. Granulated matte is treated in both furnaces.

The Bretherton Blast-heater. By S. E. Bretherton. *Eng. Min. J.*, 68, 689.—An illustrated description is given of an apparatus utilizing the waste heat of a movable forehearth for heating the blast.

Digitized by Google

A Study of the Elimination of Impurities from Copper Matte in the Reverberatory and the Converter. By E. Keller. *Trans. Am. Inst. Min. Eng.*, 28, 127–159; Discussion, 816–840.—In bringing forward 60 per cent. copper matte to metallic copper in the reverberatory furnace, the first step is to crush the matte fine and to roast it in a hand reverberatory furnace. As in large-scale work the complete clean-up necessary to arrive at satisfactory data as to losses in roasting is not practicable, the author made some small-scale experiments in dead-roasting a matte of the following composition: Cu, 60.89; S, 23.22; Fe, 12.28; Fe_3O_4, 0.34; Zn, 1.70, Pb, 0.568; Bi, 0.0501; Sb, 0.1010; As, 0.0481; Se,Te, 0.0101; Ag, 61.1 ozs.; Au, 0.20 ozs. He found by comparing raw and roasted matte that 5 per cent. of the arsenic and 15 per cent. of the antimony had been volatilized. By bringing the analyses of flue-dust and raw matte to the common basis of Cu = 100, and dividing the former by the latter, he found the relative elimination of the elements to be Cu, 1.00; Zn, 1.86; Pb, 1.88; Bi, 1.60; Sb, 8.15; As, 27.16; Se,Te, 2.80. Upon the assumption that the elimination of arsenic is proportional to that of sulphur, and that in actual roasting the sulphur content is reduced one-third, there will be found in the flue-dust the following percentages of the original quantities in the matte: Cu, 0.18; Zn, 0.34; Pb, 0.34; Bi, 0.29; Sb, 1.47; As, 5.00; Se,Te, 0.50. In smelting the roasted matte with silicious and calcic fluxes for bottoms, there are also formed regulus, slag, and incidentally some flue-dust. The author finds that arsenic concentrates three times as much as antimony or bismuth in the bottom, while lead, selenium, and tellurium concentrate in the regulus. The order in which the foreign constituents are eliminated from the regulus by slagging, volatilization, and draining into the bottom is the following: zinc, lead, bismuth, antimony, arsenic, selenium, tellurium, gold, and silver. In smelting the regulus and bottoms together in a reverberatory furnace for blister copper, the order of elimination of impurities by slagging is antimony, lead, selenium, tellurium, bismuth, and arsenic. In refining the blister copper, the impurities, slagged on the basis of 7 units slag to 100 copper, were Pb, 0.0678; Bi, 0.0009; Sb, 0.0115; As, 0.0020, while those remaining in the refined copper were Pb, 0.0093; Bi, 0.0320; Sb, 0.0651; As, 0.0586; and Se,Te, 0.0098. In refining converter copper, the order of slaggability was lead, antimony, arsenic, bismuth, and selenium-tellurium. After discussing the reduction of slags from the reverberatory process in the reverberatory furnace and of refinery slags in the blast-furnace, the author sums up the elimination of impurities in the total reverberatory process of copper smelting by comparing the values of the raw matte with those of the refined copper and

Digitized by Google

shows that the following percentages are eliminated by it: Pb, 99; Bi, 54; Sb, 50; As, 21; Se,Te, 60. In converting matte of a composition similar to that brought forward in the reverberatory furnace, the author shows that the following percentages of impurities are eliminated: Pb, 95–99.4; Bi, 94–96; Sb, 62–73; As, 73–91; Se,Te, 57.71; varying with the size of the converter and the extent to which the blowing was carried, a few minutes' overblowing being more efficient than hours of flapping in the reverberatory furnace. In the discussion of the paper the author tells of his laboratory experiments on the elimination of impurities by the James Direct Process. His results are unfavorable to it.

The Jackson System of Treating Ores. By A. PHILLIPS. *Eng. Min. J.*, **68**, 34; by VAN ZWALUWENBURG, *Ibid.*, **68**, 363–364.—A silver-gold ore is to be dead-roasted in a mechanical roaster with stationary hearth; at the discharge it is to drop into a heated chamber, being at the same time supplied with salt and iron sulphide, which are to do the chloridizing. After passing through the chamber, the chloridized ore is to be cooled by passing through the open air, then fed into tanks, leached with brine and sodium hyposulphite, and the gold precipitated by some electrical means. Van Zwaluwenburg, who experimented at a large lixiviation plant in Mexico with the electrical precipitation, found it unsatisfactory as regards the deposition of silver and that, in addition, the hypo salt was decomposed.

The Alluvial Deposits of Western Australia. By T. A. RICHARDS. *Trans. Am. Inst. Min. Eng.*, **28**, 490–537.—This paper, mainly of a geological character, has a number of interesting illustrated descriptions of the separation of placer gold from sands by dry-blowing.

Water Required for Stamp-milling. By G. W. RITER. *Eng. Min. J.*, **68**, 278.—The author gives some data from his experience with ores from Eureka Hill, Tintic District, Utah, on the water required by the combination process, *i. e.* stamping, concentrating, and treating of settled tailings by pan amalgamation. The amounts required per ton of ore were $1\frac{8}{8}$ tons for crushing, concentrating, amalgamating, and retorting; and, if the steam required for power, drying concentrates, heating pans, etc., be included, this figure was raised to nearly 2 tons.

Silver-Plating of Amalgam Plates for Gold Mills. By A. J. CLARK. *School Mines Quart.*, **21**, 48–56.—The paper is a description of a method used for replating the silver-plated amalgam plates (54 inches wide and 8–12 feet long) of the mills of the Homestake and Higland Mining Cos., at Lead City, S. D., after these

Digitized by Google

had shown a decrease in recovery of gold as soon as the original plating had begun to wear off. In order to have the silver adhere firmly to the copper plate, this must be absolutely clean. On a new plate, any scale rolled into the surface would cause the silver to form a rough deposit easily rubbed off in the daily collection of amalgam. A thin film of oxide or grease would give a somewhat uneven deposit, quickly washed off by the stream of pulp. On an old plate, after scraping off the remaining amalgam, the quicksilver has to be removed. Scraping by hand with acid treatment proved unsuccessful. Stripping (solution of any gold, silver, mercury, by the anode action of an electric current using iron plates as cathodes and potassium cyanide as electrolyte) proved successful as far as the cleaning was concerned, but it left the copper plate pitted, and while it took a good silver deposit, when used in the battery it did not work satisfactorily, the heavier sands settling in the hollows. Stripping had to be supplemented by a power scraper. A buff wheel with an emery-cutting surface was used, a small fan sucking off the cuttings and discharging them into a box filled with water. The scrapings were amalgamated in a Knox pan yielding a bullion with Au, 5–14, Ag, 14–23, and Cu, 72 per cent. Two men clean three plates in ten hours. The plates were painted twice on the reverse side with a solution of asphaltum in turpentine and then brought to a slightly inclined working table having cross strips of wood covered with rubber and a gutter to carry off the washings. The wood was painted with asphalt, and the whole placed under a hood connected with a fan. The scraped side of the plate may require scouring with sand or pumice stone to remove scale (the sand going to the mill), acid treatment (equal amounts of nitric and sulphuric acids with 1–5 per cent. of hydrochloric acid) to remove remaining oxides or mercury, a hot concentrated potash or soda wash to remove grease, a painting with potassium cyanide followed by one with cyanide of mercury, which tends to improve the adherence of the deposit. The depositing vat was 15½ feet long by 30 inches wide; it was made of 3-inch red-wood, heavily strapped, and lined with a layer of asphaltum by melting and pouring it in and ironing it out. The tanks were found to spread 2½ inches when filled, necessitating loosening the nuts of the straps. The depositing vat was set in a cement vat 3 feet deep to catch any leakage. There was a tank of pine wood, 10 × 5 × 5 feet, painted with asphalt into which the solution could be siphoned when it might require to be renovated. A plate was suspended by long hooks (passing through holes punched 2 feet apart along the edge) from a longitudinal bar held at the ends by a differential pulley and supported in the center by a lever. The electrolyt was a solution of silver chloride in potassium cyanide carryin

Digitized by Google

2.5 ozs of silver and one-half pound of potassium cyanide to the gallon. From 15–20 silver plates, 3 feet by 6 inches and one-fourth inch thick, were used as anodes for one copper cathode. With a single plate and an electrode distance of 16–17 inches, an electromotive force of 1.5 volts was ample. With a pair of plates hung back to back with anodes on either side and an electrode distance of 10–12 inches, 2–2.25 volts were necessary. The rate of deposition was 0.35-0.50 oz. per square foot per hour. A new solution did not work so well as one that had been used for some time. Every day the solution had to be stirred to correct a tendency of layering. After the deposition has been going on for 10 or 15 minutes the plate is drawn out and any imperfections corrected by scouring. The composition of the electrolyte has to be checked by determining the silver and free potassium cyanide.

De LaMar's Mercur Mines. By H. L. J. Warren. *Eng. Min. J.*, **68**, 754–756; 787; 788.—The paper discusses the occurrence of the ore, the mining and the metallurgical treatment. There are two varieties of ore, oxidized and base; a third class called mixed ore, a talcose oxidized material, is recognized in the mill. The gangue consists of quartzite, limestone, shale, and clayey talcose material; it contains 20–30 per cent. SiO_2. The oxidized ore is yellowish to brownish, the base ores carry 1–5 per cent. realgar and orpiment, cinnabar is occasionally found. The value in gold shows a range of \$2.00–\$60.00, and usually varies from \$3.00–\$12.00 per ton. The ore is passed through crushers, roughing rolls, and finishing rolls with intervening screens, leaves the last reduced to a limiting sieve with one-eighth inch holes. The oxidized ores are leached raw, the mixed ores are calcined in two Holthoff-Wethey mechanical furnaces (100 × 12 feet), passing through them in six hours. Each treats 145 tons in 24 hours, and consumes 8 tons of coal. The object of calcining is to remove the combined water and thus render the ore readily leachable. The base ores with 2–5 per cent. sulphur and 0.95–2.50 per cent. arsenic are roasted in 4 Jacklin mechanical furnaces (120 × 12 feet) passing through them in 8 hours. A furnace roasts 70 tons in 24 hours, consuming 7 tons of coal, and reduces the arsenic to 0.10–0.15 per cent. The oxidized, calcined, and roasted ores are collected together in a general charging bin whence they go to the leaching vats. There are 26 steel leaching tanks (50 × 25 feet and 5 feet deep), each holding 250 tons of ore. On the bottom are spread 50 tons of cherty material, making a 10-inch filter bed. A tank is filled from side dump-cars by 3 men in 8 hours. First a strong 0.4 per cent. solution of cyanide is turned on from the bottom through 10 2-inch openings; it takes 8 hours to rise to the sur-

Digitized by Google

face, stands 16 hours, and then leaching by percolation is begun and continued for 24 hours. The first leaching is followed with a weak (0.3 per cent.) solution until the gold has been extracted, which takes two or three days, after which the wash-water is turned on. The rate of washing is one inch per hour, the weight of solution and wash-water used is about twice that of the ore. The leached ore is shoveled through openings in the bottom into cars by ten men in four hours. Solutions and wash-water flow into two collecting tanks (20 feet in diameter and 12 feet deep), whence they are pumped into three precipitating tanks (16 feet in diameter and 8 feet deep). The gold is precipitated by means of zinc dust. While the solution flows into a tank it is kept stirred by compressed air passing at a pressure of 20 pounds through a one-half inch pipe. When a tank is filled with its first solution, 30 pounds of zinc dust are given, with the second charge 20 pounds, and with the third and the rest 10 pounds, 15 pounds being required on the average for a full charge of liquor, which weighs 30 tons. When the precipitation is finished, the solution is allowed to settle and is passed through ten filter-presses (Stillwell-Bierce and Smith-Vaile pattern, 24 inches square) into a sump 24 feet in diameter and 8 feet deep. The solution before precipitation contains $3.00 gold per ton, and after precipitation $0.20; the zinc consumption is 1⅛ pounds per ounce of gold. Before bringing the low solution to the normal standard by the addition of fresh potassium cyanide, one pound of caustic soda is added to a ton of solution so as to preserve its alkaline character. At the monthly clean-up, the precipitate from the vats and filter-presses is dried and heated in shallow pans in a muffle furnace to oxidize the zinc, and then crushed to pass a one-fourth inch screen. It contains about 20 per cent. gold; there is always present 1 part silver to 100 parts of gold. The crushed material is treated with sulphuric and nitric acids and brought up to 60 per cent. gold. It is now filtered in a press, dried in a muffle, broken to one-half inch size, mixed with flux (1 potash, 2 soda, and 2 borax), and melted down in a graphite crucible. The gold is 950 fine.

Mill Practice of the Utica Mills, Calaveras County, California. By W. J. Loring.—*Trans. Am. Inst. Min. Eng.*, 28, 553–565. —The paper gives full practical details of the manner of working at the three mills containing 120 stamps in all. Of special interest is the use of shoes of manganese-steel, 8.5 inches in diameter of face and 10 inches high, which last on the average 296 days, weighing 177 pounds when new and 28 pounds when used up so that they have to be exchanged. Manganese-steel has also done better work in the crushers than any other kind of iron. A stamp weighs 835 pounds, drops 7–8

Digitized by Google

inches 100 times a minute, crushes per day 4.8 tons through a fine, round-punched screen (corresponding to 30-mesh), requires per battery of five stamps 8.5 gallons of water per minute, and 2.5 gallons per minute for the two concentrators belonging to it. The consumption of quicksilver per ton of ore is 0.076 ounce. Concentrates from the vanners and the Gates canvas-plant are chlorinated and the slimes finally treated with potassium cyanide. The cost of milling, exclusive of power, is 13.8 cents per ton. For further details the reader must be referred to the original paper.

Cyaniding Slimy Ores and Tailings. By M. W. Alderson. *Min. Sci. Press*, **78**, 584, 612, 636, 665; **79**, 4.—The author discusses first the early attempts at cyaniding slimes in Montana. He then takes up the treatment by agitation and illustrates the working of a vertical agitator with steel propeller blades, rotating at the rate of 16 revolutions per minute in a vat 16 feet in diameter and 5 feet deep, holding 20 tons sands or 12 tons of slimes. With the ore are charged 12 pounds of lime to neutralize any active acidity and to aid in settling the slime. For a ton of ore there is required usually one ton of solvent, rarely 1.5–2 tons. The agitation is continued until a sample of solution shows the enrichment it ought to have, this being ascertained by preliminary tests. When agitation has been stopped, the charge is allowed to settle. After 1–2 hours, decantation can be begun by removing the plugs one after another from the 3-inch auger-holes bored in the sides. Decantation is continued until there remains not more than one-half inch of clear solution on top of the slime. The decantation of the strong solution is followed by two washes of 2 or 3 tons of water per ton of ore. The whole operation takes about 30 hours. The tailings are discharged at the bottom into a launder. The gold solution is collected in a vat with floating drain and passes through the zinc boxes. Trouble is here encountered on account of the very weak solutions, the original solution being greatly diluted by the decantations. The author overcame the difficulties by periodically allowing the zinc shavings in the extractor to stand in contact with a solution very much stronger than the normal (one-half pound cyanide to 1 ton solution) in order to remove incrustations formed by the weak normal solution. He did this by placing, every 6 hours, 1.5 pounds potassium cyanide in the head compartment. The extractor, 3 feet wide by 12 feet long has 7 compartments, the first four are 18 × 18 inches, the last three 12 × 18 inches, and treats 30 tons solution in 24 hours. Most of the cyanide works send their precipitated gold to a United States assay office to be refined. The author, after experimenting in vain with sulphuric acid and hydrochloric acid,

Digitized by Google

tried nitric acid, which worked satisfactorily. The dissolved silver was precipitated by salt and the chloride decomposed by fusion, etc.

Cyaniding at Gilt Edge, Montana. By M. W. Alderson. *Min. Sci. Press*, 79, 408.—The gangue of the ore is porphyry and altered limestone averaging 20 per cent. SiO_2. The porphyritic ore assays $3–$10 and the limestone as high as $300 per ton, average ore assay $7.00. Everything down to $3.00 goes to the mill, which has a capacity of 160 tons per day. The ore reduced to one-fourth inch size is charged into six steel vats 28 feet in diameter and 6 feet deep, each holding 70 tons of ore. It is first treated with a solution containing 4 per cent. cyanide (one-quarter ton solution to 1 ton ore), which remains 8 hours in contact with it. This is followed by the leaching solution, 0.24–0.25 per cent. cyanide, which percolates in 52 hours, and the leaching solution by two wash-waters of 6.5 tons each. The ore when charged contains 4 per cent. water, when drained, 13 per cent. In the leaching room there are besides the ore vats, two solution tanks (12 feet in diameter and 4 feet in height), one sump tank (14 × 4 feet) and one water tank (14 × 12 feet). In the precipitating room are six zinc boxes, the precipitated gold is treated with sulphuric acid, the refined bullion is 900–1000 to 950–1000 fine. The tailings average $1.00. The cost of treatment in July, 1899, was $1.32 per ton, a total of 2800 tons being handled. There was consumed about one-eighth pound potassium cyanide per ton of ore.

The Pneumatic Cyanide Process. By J. Webb. *Eng. Min. J.*, **68**, 4.—The idea of the process is to stir with compressed air a warmed cyanide solution, thus permitting a quick treatment of slimes or ores crushed very finely, and a degree of aeration otherwise not attainable. The process is still in the experimental stage.

The Pneumatic Cyanide Process. By A. Del Mar. *Eng. Min. J.*, **68**, 94.—The author criticizes the process on account of the greatly increased consumption of cyanide which must follow from the continuous air-stirring of the warmed solution.

Notes on Tuyeres in the Iron Blast-furnace. By J. M. Hartman. *Trans. Am. Inst. Min. Eng.*, **28**, 666–673, 902–907. By B. F. Fackenthal. *Ibid.*, **28**, 673–678, 858–872.

Note on the Use of the Tri-axial Diagram and Triangular Pyramid for Graphical Illustration. By H. M. Howe. *Trans. Am. Inst. Min. Eng.*, **28**, 346–355, 894–901.—In representing graphically the properties of slags the tri-axial diagram

Digitized by Google

serves an excellent purpose. To illustrate it, the author has plotted the total heats of solidification of an extended series of lime-alumina-silicates examined by Prof. Åkerman. The lines joining the points of equal total heat of solidification, called "isocals," tell a clear story of the relation between composition and total heat of solidification. The author further outlines the use of a triangular pyramid for the graphical representation of four variables.

Analysis of Blast-furnace Gas while Blowing In. By R. H. SWEETSER. *Trans. Am. Inst. Min. Eng.* **28,** 608–613.—The paper is a record of analyses of the gas made during the blowing-in of the furnace "C" of the Maryland Steel Co., at Sparrow's Point, Md., the time covered being from 12.26 P.M. of one day to 2.45 P.M. on the following day. With the analyses are tabulated the revolutions of the engine, the pressure and the temperature of the blast, and the height of the stock. These figures, as well as the conditions of normal work, are graphically represented to facilitate comparison.

Note on the Forms Assumed by the Charge in the Blast-furnace, as Affected by Various Methods of Feeding. By F. FIRMSTONE. *Trans. Am. Inst. Min. Eng.*, **28,** 370–395.—This is an extended illustrated paper on the effects of different methods of feeding on the distribution of ore, flux, and fuel in the blast-furnace, and on the working of the furnace itself.

Note on Slips and Explosions in the Blast-furnace. By F. B. RICHARDS. *Trans. Am. Inst. Min. Eng.*, **28,** 604–608, 911–919.—Two illustrations accompanying the note represent the Claire furnace of Sharpsville, Pa., one while in normal condition and the other 5 seconds after an explosion or slip had taken place. The second picture shows the tremendous force of the accidents caused by the use of fine Menominee and Mesabi ores. The furnace, 75 feet high, with a 16-foot bosh, a 10-foot 6-inch hearth, and 13 tuyeres, was working an ore mixture containing 37.5 per cent Mesabi ore, 25 per cent. of which would pass through a 100-mesh sieve, the balance coming from the Menominee and Marquette ranges.

The Manufacture of Sulphur-free Mineral Wool. By A. D. ELBERS. *Eng. Min. J.*, **68,** 248–249.—The paper gives a review of the manufacture of mineral wool and discusses the process invented by the author for freeing it from calcium sulphide, a substance which has prevented mineral wool from being used as much as it deserves. The process consists in remelting iron blast-furnace slag with moderate quantities of gypsum or other alkaline earth sulphates, when the reaction $3CaSO_4 +$

Digitized by Google

$Ca(Mg, Fe)S = 3CaO + Ca(Mg, Fe)O + 4SO_2$ takes place, and the sulphur dioxide is carried away by the gases, the atmosphere in the cupola being sufficiently oxidizing to prevent its reduction. Some of the gypsum charged cannot but be superficially reduced to calcium sulphide, and has to be reoxidized by the remaining sulphate; thus more gypsum is required than is called for by the formula.

The Utilization of Blast-furnace Slag. By A. D. Elbers. *Eng Min. J.*, 67, 649–650, 708.—The author discusses the possible uses to which iron blast-furnace slags have been and can be put, and then takes up their desulphurization.

The Kytchtym Medal. By P. Frazer. *Trans. Am. Inst. Min. Eng.*, 28, 613–617, 848–854.

Blast-furnace and Cupola Practice. By E. S. Cook. *J. Am. Foundrymen's Assoc.*, 6, 295–313; *Iron Age*, 63, *May 11, 1899.*—The paper compares in a general way the work in the blast-furnace and the foundry cupola. The following points are not generally known: 1. Iron run into chilled molds contains more graphitic carbon than when run into sand beds. Thus cast No. 81, of the Warwick furnace, showed in chilled molds: graphitic C, 2.87; combined C, 0.48; total C, 3.35; Mn, 0.42; P, 0.36; S, 0.017; Si, 1.50; and in sand molds graphitic C, 2.57; combined C, 0.42; total C, 2.99; Mn, 0.41; P, 0.36; S, 0.010; Si, 1.52, the reason being that the iron molds are dry and frequently warm. 2. In casting by a machine, the cold iron molds will have a chilling effect on the iron, and disturbing the crystallization, will interfere with the usual grading by fracture, hence a new method of grading (by composition) becomes necessary. The leading components being silicon and sulphur, the grading ought to be as follows:

	No. 1.	No. 2x.	No. 2, soft.	No. 2, plain.	No. 2, strong.	No. 2 foundry.
Silicon....	2.50–3.00	2.00–2.50	2.50–3.00	2.00–2.50	1.50–2.00	1.50–2.50
Sulphur ..	0.02 and less	0.02 and less	0.05 and less	0.05 and less	0.05 and less	over 0.05

3. The furnaceman as well as the foundryman finds a guide for the quality of the pig in casting chill-cup test-pieces, as iron of certain grades will not take a chill. At Warwick, for example, iron low in manganese with 1.5 per cent. Si and that with 0.03 per cent. S will not take a chill; with 1.00 per cent. Si and 0.02 per cent. S there may be a slight chill; with 0.08 per cent. S the chill will be one-half inch deep. Pig with 2–3 per cent. Si and 0.05 per cent. S will not chill; with 0.10 per cent. S a chill will be seen in spite of the high percentage of silicon. The chill produced by sulphur is very different from that resulting from a lack of silicon.

Digitized by Google

Modern Cupola Practice with Special Reference to the Discussion of the Physics of Cast-iron. By B. S. Summers. *Trans. Am. Inst. Min. Eng.*, **28**, 396–413, 769–796, 884–893.—In foundry practice it is held by many that the silicon is the governing element; the author disagrees with this opinion, believing that graphitic carbon controls the value of a casting. While the most prominent function of silicon in foundry iron is that it promotes the formation of graphitic carbon, it also lowers the saturation of iron for carbon. Machinery castings of close texture should contain between 1.50 and 2.00 per cent. silicon and may reach 2.25 per cent.; light hardware may contain as much as 3 per cent. silicon; with more than 3 per cent. silicon, castings become brittle; for ordinary castings sulphur, which interferes with some of the good effects of silicon, should not exceed 0.10 per cent., and had best be kept below 0.08 per cent. While pig-iron rarely contains a harmful amount of sulphur, it is often introduced into the mixture through ferrosilicons, some well-known brands of which the author found to contain 0.17–0.18 per cent. The limit of phosphorus for most cases is about 1.00 per cent; where great strength is required the percentage ought to be much lower. As to manganese, 0.80 per cent. will hardly be noticed and it may reach 1.00 per cent. On account of the property of manganese to counteract the formation of blow-holes or the iron becoming spongy, the use of manganese is desired so long as it does not harden the iron. As to the forms of carbon, the author is inclined to attribute a considerable importance to amorphous temper carbon, and believes that the closer and denser fracture of charcoal-iron over coke-iron may be attributed to it. The reviewer would point out that the microphotographs of Glinz, published in *Stahl und Eisen*, 1899, page 1062, show that this difference in fracture is due rather to the more uniform distribution of graphite than to the presence of temper carbon. As to the relation of silicon and graphitic carbon, the author shows by analysis that an increase of silicon does not have a corresponding increase in the graphitic carbon; in fact, records for months in works show that silicon varying between two and three per cent. has much less effect on the separation of carbon as graphite than is usually supposed. The effect of silicon seems to be governed more by the temperature at which it is allowed to act. The higher the coke consumption up to a certain limit, and with it the larger the volume of blast, the greater will be the total carbon and the percentage of graphite. Rusty scrap-iron, especially if much corroded, has a tendency to make iron spongy.

The Manufacture of Car Wheels. By G. R. Henderson. *The Foundry*, 15, 48–53.—The paper discusses the control by

Digitized by Google

mechanical tests and chemical analyses of the materials used in the manufacture of the finished product. Bars of wheel-iron 2 inches square by 24 inches should stand, with supports 21½ inches apart, a center load of 12,000–14,000 pounds before breaking, showing a deflection of 0.2 inch at center; in testing, the amount of chill, the shrinkage, and the fracture should be noted. Car wheels should show the following limits in chemical composition: graphitic C, 2.75–3.00; combined C, 0.50–0.75; Si, 0.50–0.70; Mn, 0.50–0.75; S, 0.05–0.07; and P, 0.35–0.45 per cent.

The Malleable Iron Industry: Its Development in the United States. By G. C. DAVIS. *J. Am. Foundrymen's Assoc.*, 6, 59–67.—This paper is a historical one. In 1853 there were five foundries in this country making malleable castings. At present there are ninety with a capacity varying from one to eighty tons per day.

The Basic Furnace for Malleable Iron. By E. C. WHEELER. *The Foundry*, 14, 247–250.—The author advocates the use of an 8–10 ton basic open-hearth furnace for foundries having a tonnage of 60–100 tons per day. A heat would be tapped into a ladle attached to an overhead traveling crane, and its contents poured into small ladles when the moulder's floor had been reached. While pouring, the melting furnace would be recharged and the fusion well under way before the pouring was finished.

Suggested Improvements in the Manufacture of Bar-iron. By S. PETERS. *Proc. Eng. Soc. Western Pa.*, 15, 222–230; *Iron Age*, 63, *May 11, 1899*, 14–15.—In puddling gray-forge iron, 500–600 (sometimes 1,000) pounds of iron ore are required per ton of muck bar, exclusive of tap-cinder and squeezer-cinder. This forms a very large amount of slag which is liable to retard somewhat the process; a lack of cinder is perhaps still more harmful, as the impurities will not be sufficiently diluted in the cinder, and will with the slag reenter the puddled ball; further, the refining will be retarded, and hence the welding of the granules. The improvement suggested is to melt down the pig in a cupola, transfer to a Bessemer converter, and desiliconize and mostly decarbonize (Si, 0.05; C, 0.5; P, 0.5; S, 0.05), transfer the liquid metal to a rotary reverberatory furnace lined with bauxite or magnesite, remove with small addition of raw ore, carbon and phosphorus making as acid a slag as is permissible (say 15 per cent. SiO_2). By delivering to the balling furnace metal in definite quality and of definite composition, and by regulating the quality and quantity of the slag, more uniform

Digitized by Google

results will be obtained than at present; moreover, more work can be done on a large scale.

The Relations between the Chemical Constitution and the Physical Character of Steel. By W. R. Webster. *Trans. Am. Inst. Min. Eng.* **28,** 618–665, 876–883.—The author gives a review of the subject accompanied by a general discussion and tables, to which the reader is referred.

Notes on the Bertrand-Thiel Process. By J. Hartshorne. *Trans. Am. Inst. Min. Eng.*, **28,** 254–264.—The paper is a report on the progress made with this process since 1896. It gives the titles of the papers published on the process, discusses them briefly, and summarizes the results obtained at Kladno, using pig and scrap, cold pig iron alone, and molten metal from the blast-furnace.

An Explanation of the Rapidity of the Bertrand-Thiel Process. By H. M. Howe. *Eng. Min. J.*, **68,** 276–277.—In this process, which is a modification of the basic open-hearth process, cast-iron is melted down in one furnace and the elimination of phosphorus and silicon started; scrap and ore are melted down at the same time in a second furnace situated at a lower level, where the iron becomes somewhat oxidized; now the metal from the upper is tapped into the lower furnace and its slag diverted during the flow. The two charges react quickly, and the carbon and phosphorus are rapidly removed. By the removal of silicon and the partial elimination of phosphorus in the upper furnace, with a slag that is not very basic relatively little lime has to be added with the result that a smaller quantity of slag per unit of iron is produced than in the regular practice, which aims to remove the whole of the phosphorus in one operation. This smaller amount of slag leaves more room in the furnace for the metal charge. The partly treated metal charge free from slag meets, in the lower furnace, iron oxide containing very little slag, hence the reaction is vigorous and the amount of slag formed small, which again leaves more room for the metal. The higher temperature over that in the ordinary process is explained by the higher initial temperature of the substances brought together. The frothing of the charge in the lower furnace during the boiling period is less, on account of the smaller amount of slag and its higher temperature.

ASSAYING.

H. O. Hofman, Reviewer.

Experiments in Sampling Silver-Lead Bullion. By G. M. Roberts. *Trans. Am. Inst. Min. Eng.*, **28,** 413–427.—The

Digitized by Google

conclusions arrived at by the author as a result of his experiments are that dip-samples and saw-samples give the only true results, and that the chip-samples from top and bottom are unsatisfactory. For casting a bar from a set of samples, the author advocates melting down quickly in a red-hot crucible. He found that no loss by volatilization took place in melting, and that the loss by absorption in cupelling 400-oz. bullion was not more than 0.06 oz. per ton.

The Calkins Cupel Machines. By R. P. Rothwell. *Eng. Min. J.*, **68**, 639.—A compact apparatus is described for compressing cupels by a compound hand-lever with die and two disks serving as mould and support.

Scorification and Cupellation without Muffle. A New Furnace and Method for Gold and Silver Assays. By G. A. Koenig. *Trans. Am. Inst. Min. Eng.*, **28**, 271–288.—The author describes and illustrates a furnace constructed by him combining the crucible and muffle furnace. It consists of an oblong brick chamber closed at the bottom by a tile and at the top by a hinged roof. The heat is supplied at the back by a gas or gasoline flame, which heats the six Battersea F. crucibles that the furnace holds. For scorification- and cupellation-assays a narrow fire-clay tile is placed longitudinally in the furnace to carry the scorifiers or cupels. The gas flames travel underneath the tile and rise at the front where there are blowpipes to furnish the air necessary for oxidation. The author finds that his cupellation results compare favorably with those obtained in the muffle as to accuracy, and have the advantage of taking from one-fourth to one-sixth the time required by the ordinary method, and of making the work easier for the assayer, who has not to suffer from any heat whatever. By this new method of cupelling, the lead is little absorbed by the bone-ash of the cupel, which does not become very hot, but is rather volatilized.

Proof Gold and Silver. By C. Whitehead. *Eng. Min. J.*, **68**, 785–786.—The method for proof gold consists in rolling out the gold to a ribbon, treating in a flask with hydrochloric acid, to which nitric acid is added until the solution is completed, evaporating to dryness, with the addition of hydrochloric acid if necessary, to remove all nitric acid, adding a few cubic centimeters of hydrobromic acid, diluting with water to 1 oz. Au in 1 gal., agitating, allowing to settle, siphoning off the clear gold solution through a double filter, without disturbing the precipitate or washing the filter, and precipitating the gold with sulphurous acid. The gold is redissolved, etc.; but now precipitated with a warm solution of concentrated oxalic acid solution and the precipitations are repeated and the precipitate washed

Digitized by Google

with water, nitric acid, water, hydrochloric acid, and water. The pure gold is melted with one-fifth of its weight of 3 parts of fused borax and 1 part of niter in a porcelain crucible and cast into a chalked mould. The bar is cleaned by brushing and heating with hydrochloric acid, dried, cut up, rolled, the ribbons are boiled in acid, washed, and heated to redness in a muffle. The method for silver consists in wrapping fine (999) silver in filter-paper and enclosing it in a cotton bag and then electrolyzing with silver nitrate containing 1 per cent. free nitric acid as electrolyte. Pure silver crystals are deposited on the cathode. They are washed, dried, melted with the gold flux, the bar is remelted, but without any flux, and the melted silver stirred with wood to remove occluded oxygen. It is poured into a chalked mould, cleaned by brushing, and with dilute sulphuric acid, and washed, dried, and rolled out ready for use.

Assaying Telluride Ore for Gold. By R. W. Lodge. *Tech. Quart.*, **12**, 171–174.—The author compares the scorification and the crucible methods for the assay of telluride gold ores, and concludes that satisfactory results can be obtained with either, as long as the samples are ground sufficiently fine, with rich ores through a sieve of not less than 140 meshes to the linear inch.

A New Assay for Mercury. By R. E. Chism. *Trans. Am. Inst. Min. Eng.*, **28**, 444–452.—The method described is a modification of the one devised by Eschka. A Battersea gold-annealing cup, size C, fitted into a circular opening of a piece of tin plate so as to protrude about 1 cm., holds the charge of ½ to 1 gram of ore mixed with 5 grams of prepared iron filings. It is heated with a spirit lamp having a wick 6 mm. in diameter, drawn out to produce a flame 4 to 5 cm. high. The volatilized mercury is condensed on a piece of silver foil, about 5 cm. square, which is kept cool by a flat silver or copper dish 5½ to 6½ cm. in diameter, and somewhat over 1 cm. high, holding about 20 cc. of water. The time required for an assay is ten to fifteen minutes. After weighing the silver foil, it is placed again on the crucible, which is heated for ten minutes more to see if there is any gain in weight. The results are accurate.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. No. 4.

ARTHUR A. NOYES, Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

Some Double Halides of Cadmium with the Methylamines and Tetramethylammonium. By C. D. RAGLAND. *Am. Chem. J.*, **22**, 417–434.—These double salts were prepared by bringing together concentrated solutions of the separate salts. The volumes of the solutions were so taken as to vary the molecular proportions, making a series in which the salts varied from a 1 : 4 to a 4 : 1 mixture. When solutions of methylamine hydrochloride and cadmium chloride were mixed in varying proportions, only one salt could be obtained, that of the 2 : 1 type. With cadmium chloride in large excess there was some evidence of another salt, but it could not be obtained in pure condition. Methylamine hydrobromide and cadmium bromide form two salts representing the 1 : 1 and the 2 : 1 types. It was impossible to prepare the double iodides. Dimethylamine hydrochloride and cadmium chloride form three salts in which the proportions of the former to the latter are 1 : 1, 1 : 2, and 3 : 2. The double bromides likewise form three salts, but of the types 1 : 1, 2 : 1, and 1 : 4. Dimethylamine iodide and cadmium iodide form one salt in which the ratio is 1 : 1. Trimethylamine hydrochloride and the hydrobromide with the corresponding cadmium salts each give two double salts of the same types, 1 : 1 and 3 : 2. Trimethylamine iodide and cadmium iodide form the 1 : 1 and 2 : 1 salts. Tetramethylammonium chloride forms with cadmium chloride the one salt in which the proportions are 1 : 1. The 1 : 1 and 2 : 1 salts are formed with tetramethylammonium bro-

Digitized by Google

mide and cadmium bromide and with tetramethylammonium iodide and cadmium iodide. The 3 : 2, 1 : 2, and 1 : 4 salts have no analogues among the double halides of the alkali metals and ammonium with cadmium.

Some Double Halides of Tin with the Aliphatic Amines and with Tetramethylammonium. By C. G. Cook. *Am. Chem. J.*, **22**, 435–446.—These salts show a marked regularity throughout the series. With the single exception of the triethylamine chlorstannate, which is a 3 : 1 salt of the composition $[(C_2H_5)_3NH]_3SnCl_6$, all of the series are 1 : 1 or 2 : 1 salts. The double salts formed by bringing together the chlorides of methyl, dimethyl, trimethyl, ethyl, triethyl, and tetramethylammonium with stannous chloride are all of the 1 : 1 type. Stannous bromide forms the 1 : 1 type with the bromides of methyl-, dimethyl-, and ethylamine. All of the above amine salts give with the corresponding halogen salt of stannic tin, the 2 : 1 type of salt. In addition, trimethylamine and triethylamine bromstannate are described. Both are 2 : 1 salts. When stannous chloride was mixed with triethylamine hydrochloride oxidation always took place, so that from such solutions it was possible to isolate only the chlorstannate.

Notes on the Double Halides of Tin with the Organic Bases. By George M. Richardson and Maxwell Adams. *Am. Chem. J.*, **22**, 446–449.—The authors describe a few additional salts of this series which were not found by Slagle (*this Rev.*, **5**, 29). Tetraniline chlorstannate was obtained by concentration of solutions of aniline hydrochloride and stannous chloride, after the first crop of crystals, dianiline chlorstannite, had been removed. Dimethylaniline chlorstannite, $C_6H_5NH(CH_3)_2.SnCl_2.\frac{1}{2}H_2O$, was prepared in the same way, and is entirely analogous to the corresponding toluidine compounds described by Slagle. Aniline bromstannite, $C_6H_5NH_2SnBr_2$, dianiline bromstannate, $(C_6H_5NH_2)_2SnBr_6$, and tetraniline bromstannate,

$$(C_6H_5NH_2)_4SnBr_6,$$

were prepared and described.

On the Effect of Various Solvents on the Allotropic Change of Mercuric Iodide. By J. H. Kastle and Mary E. Clark. *Am. Chem. J.*, **22**, 473–484.—Kastle had previously observed that the yellow modification of mercuric iodide could be obtained by dissolving the red modification in boiling amyl alcohol and allowing the solution to cool. The authors have now studied the solutions of mercuric iodide in a large number of organic solvents of different boiling-points. With the exception of the solutions in the alkyl halides, which were colored pink due to a

Digitized by Google

small amount of double decomposition, all solvents tried were colored yellow. From these solutions the yellow modification crystallized, but on standing it gradually passes back into the red form. When an excess of red mercuric iodide is used in a solvent some of the solid is changed to the yellow. The yellow crystals which come out of solution are soon converted into red on coming in contact with the red variety. Low-boiling liquids apparently produce the conversion as well as high-boiling liquids. Mercuric iodide, like phosphorus, appears capable of existing in solution and in the form of vapor only in the condition of the yellow compound, and this is either identical with or a polymer of the solid yellow mercuric iodide.

The Preparation of Pure Tellurium. By James F. Norris, Henry Fay, and D. W. Edgerly. *Am. Chem. J.*, 23, 105–119.—This paper is a preliminary study of methods for the preparation of a pure material which might be used for a determination of the atomic weight of tellurium. The tellurium was obtained from a residue produced in the electrolytic refining of copper. The residue was extracted with strong hydrochloric acid, and from this solution the tellurium was precipitated with acid sodium sulphite. Much of the selenium which is invariably present may be removed by filtering off the first precipitate produced by acid sodium sulphite. Further addition of sulphite throws out the tellurium with traces of other elements which may be present. To purify the crude metal it was added to warm, dilute nitric acid (sp. gr. 1.25), and the resulting solution evaporated to dryness, in order to insure complete removal of silica. The basic nitrate of tellurium was converted into oxide, extracted with hydrochloric acid, and from this solution it was again precipitated as a metal, dissolved in dilute nitric acid, and the basic nitrate, $Te_2O_3(OH)NO_3$, obtained by crystallization. Two crystallizations rendered it perfectly pure. It was shown to be free from selenium dioxide by a delicate reaction based on the fact that selenium dioxide liberates iodine while the tellurium is converted into tetraiodide. Other impurities were tested for but not found present. The basic nitrate of tellurium crystallizes from strong nitric acid solution in well-developed orthorhombic prisms, which are entirely stable in the air. Dilute nitric acid decomposes the basic nitrate of tellurium with formation of the dioxide. The basic nitrate does not begin to decompose until heated to 170°. At 190° the oxides of nitrogen begin to be evolved. When heated slowly to a higher temperature, decomposition continues until it is converted into the oxide. By rapid fusion of the oxide, after previous slow heating, very accurate determinations could be made. To test the homogeneity of tellurium a fractionation, involving 215 crystalliza-

Digitized by Google

tions, of the double bromide of tellurium and potassium was carried out. This salt was prepared from carefully purified materials. There were no indications, during the fractionation, of any change in the salt, so that it was necessary to make an analysis of the end fractions. To this end the basic nitrate, made from the double tellurium bromide, was decomposed in a platinum crucible arranged with several disks over which the escaping gases were forced to pass in order to avoid mechanical loss. The decomposition was accomplished slowly by heating at various periods to a gradually increasing temperature. The oxide was finally fused quickly in the oxidizing flame of a Bunsen burner. The analysis of the nitrate prepared from the tellurium from the fraction which would contain the most soluble portion, gave 83.45 and 83.44 per cent. of TeO_2; from the least soluble portion, 83.48 and 83.49 per cent. TeO_2. The fractionation, therefore, did not effect any decomposition of the tellurium which could be detected by a method capable of giving results accurate to 0.4 of a unit in the atomic weight.

The Reduction of Selenium Dioxide by Sodium Thiosulphate. By James F. Norris and Henry Fay. *Am. Chem. J.*, 23, 119–125.—In a previous paper (*this Rev.*, 4, 31) a volumetric method for the determination of selenium dioxide was described. It was based on the reaction between selenium dioxide and sodium thiosulphate, four molecules of the latter reacting with one of the former. It was not known at the time what was the nature of the reaction, but the reaction is now shown to proceed according to the equation:

$$SeO_2 + 4Na_2S_2O_3 + 4HCl = Na_2S_4SeO_6 + Na_2S_4O_6 + 4NaCl + 2H_2O.$$

The formation of sodium selenopentathionate, similar to potassium pentathionate, seemed probable since no selenium was precipitated in the reduction. A solution prepared by mixing the constituents in the proportions represented in the equation, gave all tne characteristic reactions of the pentathionates with the exception that selenium was precipitated instead of sulphur. Attempts to isolate the sodium selenopentathionate were not successful. Tellurium seems to form an analogous compound. In reply to a criticism by Mr. Norton (*this Rev.*, 5, 89) the authors have again studied the conditions under which the volumetric method can be most accurately carried out. It was found that Mr. Norton had confused *excess* of acid with *amount*. The amount, however, which was recommended by the authors is more than is absolutely necessary, although it does not interfere with the accuracy of the method. It is shown that low temperature and the presence of acid have great influence on the delicacy of the starch reaction.

Digitized by Google

The Double Halides of Antimony with Aniline and the Toluidines. By HOWARD H. HIGBEE. *Am. Chem. J.*, 23, 150–173. —Mixtures of the halide of the base were brought together with the antimony halide, each constituent having been previously dissolved in the corresponding halogen acid. From the various mixtures of aniline hydrochloride and antimony trichloride, trianiline chlorantimonite, $(C_6H_5.NH_2.HCl)_3.SbCl_3.H_2O$, crystallized from most of the mixtures; from the mixture in which the proportion of base to antimony was 1 : 2, monaniline chlorantimonite, $C_6H_5.NH_2.HCl.SbCl_3.H_2O$, was obtained. From *o*-toluidine hydrochloride and antimony trichloride only one salt was isolated, di-*o*-toluidine chlorantimonite, $(C_6H_4.CH_3.NH_2.HCl)_2.SbCl_3$; *m*-toluidine hydrochloride gave two salts, tri-*m*-toluidine chlorantimonite, $(C_6H_4.CH_3.NH_2.HCl)_3.SbCl_3$, and di-*m*-toluidine chlorantimonite, $(C_6H_4.CH_3.NH_2.HCl)_2.SbCl_3.H_2O$; *p*-toluidine hydrochloride likewise gave two salts, di-*p*-toluidine chlorantimonite, $(C_6H_4.CH_3NH_2.HCl)_2.SbCl_3.\frac{1}{2}H_2O$, and tri-*p*-toluidine chlorantimonite, $(C_6H_4.CH_3.NH_2.HCl)_3.SbCl_3.H_2O$. Aniline hydrobromide and antimony tribromide yielded the two salts $(C_6H_4.CH_3.NH_2.HBr)_2.SbBr_3$ and $(C_6H_4.CH_3.NH_2.HBr)_4.SbBr_3.H_2O$. One salt, tri-*o*-toluidine bromantimonite $(C_6H_4.CH_3.NH_2.HBr)_3.SbBr_3$ was obtained from *o*-toluidine hydrobromide and antimony tribromide; *m*-toluidine hydrobromide also gave but one salt in which the ratio of base to antimony was 2 : 1; *p*-toluidine hydrobromide gave three salts in which the ratios of base to antimony were respectively 2 : 1, 3 : 1, and 4 : 1. In dry air all three compounds are canary-yellow, but lose their color on contact with moisture. Aniline hydriodide gave with antimony triiodide three salts in which the ratios of base to antimony were 1 : 1, 3 : 2, and 4 : 1. From *o*-toluidine hydriodide and antimony triiodide the 1 : 1 and 3 : 2 salts were obtained; from *m*-toluidine hydriodide the 3 : 2 salt; from *p*-toluidine hydriodide the 1 : 1 salt.

A Preliminary Study of the Cobalticyanides. By E. H. MILLER AND J. A. MATHEWS. *J. Am. Chem. Soc.*, 22, 62–69.— The cobalticyanides of silver, mercury, copper, bismuth, cadmium, iron, manganese, zinc, cobalt, and nickel were made by bringing together half-normal solutions of potassium cobalticyanide with half-normal solutions of the metals. The composition of the precipitates and their solubilities in various reagents were studied qualitatively only.

The Carbide of Gold. By J. A. MATHEWS AND L. L. WATTERS. *J. Am. Chem. Soc.*, 22, 108–111.—By passing acetylene into a strongly ammoniacal solution of sodium aurous thiosulphate there is formed, after some time, a yellow, flocculent precipitate which, after having been dried over sulphuric acid,

Digitized by Google

gives on analysis figures which correspond to the formula Au_2C_2. Carbide of gold is highly explosive. Water decomposes it into its elements; hydrochloric acid liberates acetylene.

On the Decomposition of Nickel Carbonyl in Solution. By VICTOR LENHER AND HERMANN A. LOOS. *J. Am. Chem. Soc.*, **22**, 114–116.—The authors have confirmed the experiments of Berthelot, Mond, and others, that nickel carbonyl is decomposed by moisture. When dissolved in acetone, chloroform, benzene, toluene, or methyl alcohol, there is produced a green precipitate, the composition of which seems to be variable.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

M. L. FULLER, REVIEWER.

Some New Minerals from the Zinc Mines at Franklin, N. J., and Note Concerning the Chemical Composition of Ganomalite. By S. L. PENFIELD AND C. H. WARREN. *Am. J. Sci.*, **158**, 339–353.—The new minerals hancockite, nasonite, glaucochroite, and leucophoenicite were taken mostly from the 1000-foot level of the Parker Shaft on North Mine Hill, where they are associated with native lead and copper, clinohedrite, roeblingite, axinite, willemite, vesuvianite, datolite, barite, garnet, phlogopite, and franklinite. Careful analyses were made of each of the new minerals, and their formulæ computed. 1. Hancockite. This is a brownish-red mineral crystallizing in very minute, lath-shaped crystals, resembling those of epidote, of hardness 6.5–7, and specific gravity 4.030. The analysis gives the empirical formula $H_2R''_2(R'''.OH)R'''_2(SiO_4)_3$, or $R''_2(R'''.OH)R'''_2(SiO_4)_3$. The general formula is that of epidote, differing principally in having the bivalent metals lead (18.53 per cent.) and strontium (3.89 per cent.) isomorphous with calcium. It should be placed, therefore, in the epidote group next to piedmontite. It is named after E. P. Hancock, of Burlington, N. J. 2. Glaucochroite. Glaucochroite occurs in small orthorhombic prisms or columnar aggregates, and is sometimes twinned. It has a hardness of about 6, a specific gravity of 3.407, and in color is a delicate bluish-green. The analysis, disregarding 1.74 per cent. of lead, gives the formula $CaMnSiO_4$, which places it next to monticellite in the chrysolite group. The name is from the Greek, meaning *blue-green color*. 3. Nasonite. This is a white, massive mineral with greasy to adamantine luster, hardness about 4, specific gravity 5.425, and usually shows numerous inclusions of axinite, garnet, and glaucochroite. Its crystallization is probably tetragonal, though this could not be proved. The analyses show the general formula to be $R_{10}Cl_2Si_6O_{21}$, in which R is mostly lead and calcium. Allowing for a few particles of clinohedrite that were

Digitized by Google

noticed intimately associated with the nasonite the empirical formula $Pb_6Ca_4Cl_2(Si_2O_7)_3$, or $Pb_4(PbCl)'_2.Ca_4(Si_2O_7)_3$, is obtained. It is named for F. L. Nason, West Haven, Conn. 4. Leucophoenicite. This mineral, which is conspicuous on account of its light purplish-red color, occurs in small crystalline masses having vitreous luster, hardness 5.5–6, and specific gravity 3.848. The system of crystallization could not be determined but is probably inclined. The analyses gave the formula

$$R_8(R.OH)'_2(SiO_4)_3,$$

in which R is mostly Mn, but with some Zn and Ca. Structurally it is the exact equivalent of humite. The name is from the Greek, meaning *pale purple-red.* 5. Chemical Composition of Ganomalite. From a study of analyses, and of the analogous mineral nasonite, the authors are led to discard the formula $Pb_3Ca_2Si_3O_{11}$ for ganomalite and to substitute the formula $Pb_4(Pb.OH)_2Ca_3(Si_2O_7)_3$. Both nasonite and ganomalite are salts of the acid $H_6Si_4O_{11}$, which is intermediate between the orthosilicic acid H_4SiO_4 and metasilicic acid H_2SiO_3. The name *mesosilicic acid* (*meso* from the Greek, meaning *between*) is suggested for this intermediate acid in place of Groth's name *di-orthosilicic acid*, which the authors consider inappropriate, as the acid in question is not an orthosilicic acid, as the name would signify, but is a derivative of orthosilicic acid.

Andesites of the Aroostook Volcanic Area of Maine. By Herbert E. Gregory. *Am. J. Sci.*, **158**, 359–369.—The paper includes descriptions of the field relations and petrography of the andesite area in the towns of Chapman, Mapleton, and Castle Hill, Aroostook Co., Maine. The andesites are Paleozoic lava flows and breccias, with their associated tuffs, lying upon the upturned edges of Silurian sandstone. The augite and hornblende types predominate, but stages between andesite and trachyte, and also dacite facies are sometimes found. Exhaustive analyses show that the Maine andesites agree with the types of their class. No more alteration is found than in many of the comparatively recent flows.

On a New Mode of Occurrence of Ruby in North Carolina. By J. W. Judd and W. E. Hidden. **Crystallographic Notes.** By J. H. Pratt. *Am. J. Sci.*, **158**, 370–381.—The Cowee district, which is the locality of the rubies described, is in Macon County, a few miles north of the town of Franklin. The rubies occur mostly in tabular rhombohedral or short prismatic crystals in a basic, garnet-bearing, crystalline rock, and often inclose small crystals of the garnet rhodolite. The mode of occurrence resembles in many points that of the rubies in the crystalline

Digitized by Google

limestone of Burma. The difference in the matrix in the two instances would be of less significance if it could be established, as has been urged by one of the authors, that the Burma limestone has resulted from the slow alteration of a lime feldspar.

Note on a New Meteoric Iron found near Iredell, Bosque County, Texas, U. S. A. By WARREN M. FOOTE. *Am. J. Sci.*, **158**, 415–416.—This meteorite, some three pounds in weight, presented a somewhat rusty surface with a slight exudation of lawrencite and streaks of schreibersite. The cleavage, though not well marked, was apparently dodecahedral. An analysis showed the presence of 93.75 per cent. of iron, 5.51 per cent. of nickel, and slight amounts of cobalt, phosphorus, and sulphur. Weak etching figures were developed by dilute nitric acid.

On a New Occurrence of Nepheline Syenite in New Jersey. By F. LESLIE RANSOME. *Am. J. Sci.*, **158**, 417–426.—The syenite described was found near the town of Brookville, where it occurs in gabbroitic trap intrusive into the Newark formation. The exposures are not sufficiently good to definitely establish the relations of the syenite and trap, but the author considers that the syenite is to be regarded as dike-like intrusions, or inclosures brought up from some underlying formation, rather than as a product of magmatic differentiation of the trap. The syenite is of three varieties, nepheline syenite, hornblende syenite, and biotite syenite. In addition to the description of the occurrence and characters of the rock a very complete chemical analysis is given.

On Graftonite, a New Mineral from Grafton, New Hampshire, and Its Intergrowth with Triphylite. By S. L. PENFIELD. *Am. J. Sci.*, **159**, 20–32.—The graftonite occurs in pegmatite, where it is found as a lamellar intergrowth with triphylite. The form of the crystals is monoclinic. When fresh the mineral has a delicate salmon color resembling that of lithiophilite, but on account of the oxidation of the iron, principally in the triphylite, the color is usually dark. The specific gravity is 3.672, hardness 5, and luster vitreous to resinous. The analysis, the method of which is described in outline, gave the formula $R_3P_2O_8$, in which R stands for bivalent iron, manganese, and calcium. Detailed descriptions of its optical and crystalline properties, with a discussion of its intergrowth with triphylite, is also given.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. No. 5.

ARTHUR A. NOYES, Editor.
REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

A Revision of the Atomic Weight of Cobalt, III. The Analysis of Cobaltous Chloride and Oxide. BY THEODORE WILLIAM RICHARDS AND GREGORY PAUL BAXTER. *Proc. Am. Acad.*, 35, 61–72.—Cobaltous chloride was purified by passing air through its ammoniacal solution, precipitating with hydrochloric acid the purpureo-cobaltic chloride formed, recrystallizing this six times from ammonia solution in a platinum dish, precipitating in a Jena flask with hydrochloric acid, and heating the precipitate first in an air-bath at 200°, and then in a current of nitrogen and hydrochloric acid to expel ammonium chloride. The weighed cobaltous chloride was reduced to cobalt by hydrogen, the small quantity of alkaline chloride present in the metal and of ammonium chloride volatilizing during the reduction being determined and corrected for. The atomic weight value so obtained was 59.044, against 58.995 previously found from the analyses of cobaltous bromide (*this Rev.*, 5, 43), but the authors regard the new value as undoubtedly too large, owing to the presence of impurity, probably silica, in the chloride. The authors also attempted to prepare a cobaltous oxide of definite composition by igniting the higher oxide in a nearly complete vacuum of varying pressure, but found by reducing with hydrogen that the atomic weight values varied from 58.93 to 59.07. They conclude that the higher oxide could not be entirely decomposed without causing some reduction of the monoxide to metal cobalt. They regard the value 58.995 obtained from the analysis of the bromide as the most probable one. The article closes with a critical review of previous determinations.

Digitized by Google

Are Further Experiments Needed for Determining the Atomic Weight of Oxygen? By EDWARD W. MORLEY. *J. Am. Chem. Soc.*, 22, 51–61; *Science*, 11, 281–288.—The author recalls the fact that our present value of the atomic ratio between hydrogen and oxygen is based solely on the composition of one compound, water, and on two methods of its determination, its synthesis by weight and the volumetric ratio taken in connection with the densities of the component gases, and suggests that the certainty attaching to the ratio would be greatly increased by a new complete synthesis of water by an independent method, and by further experiments on the density of hydrogen and on the volumetric ratio. He also considers probably practicable an accurate complete synthesis of hydrochloric acid from its elements and a determination of the ratio Na : H by dissolving sodium in water and determining the loss in weight. He raises, however, at the close the question whether the value of the results to science would justify the great labor involved in these investigations, and desires an expression of opinion on this point. In view of the fact that the atomic ratio of hydrogen and oxygen is stoichiometrically one of the most important of all chemical constants, and is likely also to have great significance theoretically, it seems certain to the reviewer that scientists will not rest satisfied until that ratio has been established with the greatest possible certainty and accuracy, and it seems therefore highly desirable that an investigator who possesses the rare manipulative skill, the critical appreciation of sources of error, and the long experience, required for the successful prosecution of such researches, should continue to devote himself to them.

The Nature of the Change from Violet to Green in Solutions of Chromium Salts. By F. P. VENABLE AND F. W. MILLER. *J. Am. Chem. Soc.*, 20, 484–497.—The authors describe experiments on the fraction (found to be two-thirds) of the total sulphuric acid that is precipitated by barium chloride from green chrome alum solutions, on the amounts of ammonia required to produce a permanent precipitate in the green and violet solutions (found to be equal in the two cases), and on the composition of the gummy precipitate produced by adding alcohol to the green solution. They conclude from their experiments that the hypothesis of Recoura that the green chromium sulphate exists in solution as $Cr_4O(SO_4)_4.SO_4 + H_2SO_4$ is untenable.

The Nature of the Change from Violet to Green in Solutions of Chromium Salts. By W. R. WHITNEY. *J. Am. Chem. Soc.*, 21, 1075–1084.—In a previous article (see the preceding review) Venable and Miller claim to have refuted the hypothesis of Recoura as to the composition of green chromium sul-

Digitized by Google

phate. After presenting ten facts previously known as evidence of the presence of free sulphuric acid, the author describes the results of transference experiments of his own, in which the theoretical amount of free acid was actually caused to migrate out from the green solution, while practically no acid was separated by the current from the violet solution. The author also communicates experiments confirming those of Favre and Valson to the effect that only about one-half of the sulphuric acid in a green solution of chrome alum is precipitated immediately in the cold, and points out that the different results of Venable and Miller are no doubt due to the fact that they waited twenty-four hours before filtering off the barium sulphate. He also points out that their experiments, showing that equal quantities of ammonia are required to barely precipitate the green and violet solutions, do not have the significance attributed to them, since it is well known that alkalies at once convert the violet into the green modification.

The Nature of the Change from Violet to Green in Solutions of Chromium Salts. By F. P. VENABLE. *J. Am. Chem. Soc.*, 22, 111–114.—After stating the reasons for the contrary opinion maintained in a previous article (see above), and otherwise interpreting some of the results there described, the author accepts the hypothesis of Recoura upheld by Whitney (see the preceding review), that a green solution of chromium sulphate has the composition, $Cr_2O(SO_4)_4.SO_4 + H_2SO_4$.

The Relation of Physical Chemistry to Technical Chemistry. By WILDER D. BANCROFT. *J. Am. Chem. Soc.*, 21, 1101–1107.—The author emphasizes the importance of a knowledge of the principles of physical chemistry to the manufacturing chemist, and maintains that aside from the value of this knowledge, physico-chemical research is a better training for industrial work than research in synthetic organic chemistry. The reviewer is also of this opinion, especially with reference to this country, where the positions filled by chemists involve, as a rule, the improvement and development of processes rather than the synthetic production of new compounds.

On the Surface-tensions of Mixtures of Sulphuric Acid and Water, and the Molecular Mass of Sulphuric Acid. By C. E. LINEBARGER. *J. Am. Chem. Soc.*, 22, 5–11.—The author has determined for each 10° between 0° and 50° or 70° the surface-tensions of aqueous sulphuric acid of strengths varying from 2.65 up to 95.0 per cent. acid. He finds that the surface-tension of the strongest acid is greatly increased by the addition of relatively small amounts of water, and is but slightly affected by

Digitized by Google

rise of temperature. The latter fact is considered to point to a high degree of polymerization of the sulphuric acid molecules.

Seventh Annual Report of the Committee on Atomic Weights. Results Published in 1899. By F. W. Clarke. *J. Am. Chem. Soc.*, **22**, 70–80.—The average values of the atomic weights published last year and compiled by the author are given below, the values in parentheses being those adopted by the author in his previous report. All values are referred to oxygen taken as 16.000:

Boron, Gautier	11.016	(10.95)
Nitrogen, Dean	14.031	(14.04)
Calcium, Richards	40.126	(40.07)
Nickel, Richards and Cushman	58.709	(58.69)
Cobalt, Richards and Baxter	58.995	(58.99)
Molybdenum, Vandenberghe	96.069	(95.99)
Tungsten, Hardin	184.0	(184.83)
Cerium, Kölle	138.81	(139.35)
Palladium, Hardin	107.014	(106.36)

On Some Abnormal Freezing-point Lowerings Produced by Chlorides and Bromides of the Alkaline Earths. By Harry C. Jones and Victor J. Chambers. *Am. Chem. J.*, **23**, 89–105.—The molecular lowerings of the chlorides and bromides of barium, strontium, calcium, and magnesium are all found to have a minimum value of 4.8°–5.1° between the concentrations 0.1 and 0.2 molecule per liter. The values increase considerably with increasing concentration (in most cases up to 5.4°–5.8° at 0.6 mol per liter), in spite of the fact that the dissociation is continually decreasing, as is shown by the electrical conductivity measurements which are also given by the authors for all eight salts over a wide range of concentration. The authors suggest that the abnormal freezing-point values may arise from the combination of the undissociated salt-molecules with a large number of water molecules, thereby reducing appreciably in the concentrated solutions the amount of solvent. Freezing-point and conductivity determinations are also given for solutions of cadmium chloride and bromide, but in these cases the molecular freezing-point lowering exhibits no minimum, but steadily decreases with rising concentration.

The Melting-point of Chloral Hydrate. By C. G. L. Wolf. *J. Phys. Chem.*, **4**, 21–32.—The author has determined the melting-point of chloral hydrate under different conditions, and concludes that the variations in it found by him and previous investigators are due, not to the existence of an isomeric form, but to the presence of dissociation-products in varying amounts. When a thermometer bulb was coated with chloral hydrate and heated in a vacuum, these conditions being such that the dissociation-

Digitized by Google

products could rapidly escape as vapors, the substance did not melt below 72°, at which point rapid sublimation took place, however. On the other hand, when it was heated in a closed tube, time being allowed for equilibrium to be reached between the solid, liquid, and vapor, the melting-point was about 47°.

The Relation of the Taste of Acid Salts to Their Degree of Dissociation. By LOUIS KAHLENBERG. *J. Phys. Chem.*, 4, 33-37.—The author finds that the acid sodium salts of oxalic, malonic, succinic, malic, tartaric, fumaric, maleic, and citric acids all taste still noticeably sour in solutions containing one mol in 100–400 liters, varying only between these narrow limits, with the nature of the salt. The variation in sourness is thus very much less than the variation (1 : 70 in the extreme case) in the concentration of the hydrogen ions in the different salt solutions. Moreover, the sourness of acid sodium tartrate and malate solutions, where the dissociation is not more than a few per cent., was found to be nearly equal to that of hydrochloric acid only three times as dilute, confirming the result of Richards with acetic and hydrochloric acids, that the sourness does not depend solely on the concentration of the hydrogen ions. The author concludes that, if his results are to be interpreted by the dissociation theory, the univalent anions (COOH—COO, etc.) must, like the hydrogen ion, be assumed to have a sour taste, an "explanation which is unsatisfactory to say the least." This explanation does not, however, seem a necessary, or even a probable one, to the reviewer, for the intensity of the sour taste probably depends on the amount of some unknown chemical change produced by the acid in the ends of the sensory nerves in a short interval of time. If this change was caused catalytically by the hydrogen ions, one might expect proportionality between its rate and the concentration of those ions. If, however, the hydrogen ions directly enter into the reaction and are consumed by it, their concentration in the layer in immediate contact with the nerve will be rapidly reduced, especially if the acid solution is dilute; and the hydrogen ions so removed can be replaced, in case the acid is completely dissociated, only by the slow processes of diffusion and convection, while if the acid is more concentrated but only slightly dissociated, an immediate new supply of hydrogen ions is furnished by the instantaneous process of dissociation. Thus, according to this hypothesis, which is *a priori* as reasonable as the other, the degree of sourness of a dilute acid solution will, in general, depend on the total concentration of the acid as well as on the concentration of the hydrogen ions, which is, in fact, the principle which expresses the experimental results thus far reached.

Digitized by Google

On Thermal and Dynamic Coefficients. By J. E. Trevor. *J. Phys. Chem.*, 3, 573–576.—The article is a continuation of the general discussion of the partial derivatives of the four fundamental thermodynamic functions (*this Rev.*, 6, 9).

On the Emission and Absorption of Water Vapor by Colloidal Matter. By P. Duhem. *J. Phys. Chem.*, 4, 65–122.—The article consists of an extended mathematical discussion of the phenomenon named in the title, when it is affected by hysteresis, and of an application of the conclusions reached to von Bemmelen's observations on the dehydration of gelatinous silica and colloidal ferric hydroxide.

The Melting-point of Formyl Phenyl Acetic Ester. By C. G. L. Wolf. *J. Phys. Chem.*, 4, 123–129.—The article is largely devoted to a discussion of the observation that the ester, after heating at 100° for some hours (by which it is melted and converted in large part into the enol form), separates crystals of the keto form more quickly if the liquid is first cooled to —80° and then allowed to stand at 20° than if it is cooled directly to 20° and allowed to stand, the difference being attributed to a more rapid reconversion into the keto form, arising from the fact that the temperature in the former case is much further below the equilibrium temperature. Thus fall of temperature may accelerate a reaction.

Freezing-point Curve for Water Containing Hydrochloric Acid and Phenol. By J. A. Emery and F. K. Cameron. *J. Phys. Chem.*, 4, 130–134.—The authors have determined the freezing-points of water and hydrochloric acid solutions, 0.024–0.500 normal, when saturated with phenol. The lowerings are found to be the sums of the lowerings caused by the two substances separately. The freezing-point of the saturated aqueous solution of phenol is —1.179°.

Thermal Effects of the Dilution of Some Salts. By F. P. Dunnington and T. Hoggard. *Am. Chem. J.*, 22, 207–211.—The authors have determined the heat effect resulting when, to nearly saturated solutions of fifteen neutral ammonium, potassium, sodium, lithium, magnesium, calcium, and strontium salts, water is added, one molecule or a few molecules at a time. The heat of dilution was found to be positive for seven of the salts, negative for seven others, and positive for the first additions of water, and then negative for subsequent additions in the case of the remaining salt, calcium nitrate. The values for the first mol of water added are greatest for lithium, calcium, and magnesium chlorides (+678, +508, and +370 cals.).

Digitized by Google

A Contribution to the Study of Liquid Mixtures of Constant Boiling-point. By GARNETT RYLAND. *Am. Chem. J.*, **22**, 384–396.—The author has fractionated mixtures of eighty pairs of liquids boiling separately less than 40° apart, and finds that 45 of them yield a constant boiling fraction of the same or lower boiling-point than the more volatile constituent, two of them, such a fraction of a higher boiling-point than the less volatile constituent, and one of them, ethyl iodide (b. p. 72°) and benzene (b. p. 79°), a fraction boiling (at 74°–75°) between the boiling-points of the two constituents. This last case, which is rather remarkable from a theoretical standpoint, is further exemplified by an earlier observation of Bauer on a mixture of ethylene and propylene bromides. As this case does not seem to have been hitherto considered theoretically, the reviewer would point out that if the vapor-pressure for any composition of the mixture has a minimum value lying between the two limiting vapor-pressures of the pure liquids, it must necessarily have also a maximum value for some other composition, or *vice versa*, and therefore it must be possible to obtain *two different* mixtures of constant boiling-point, a conclusion which it would be interesting to test experimentally. The author gives the composition, determined by repeated trials of synthetic mixtures, and the boiling-point under atmospheric pressure, of the various constant boiling mixtures; and compares the observed composition of many of them with that calculated under the assumption that each component volatilizes in gaseous volumes proportional to its own vapor-pressure in the pure state at the boiling-point of the mixture. In almost all cases the so-calculated values are much larger for the less volatile, less concentrated component than the observed ones, a result which is, however, in accord with the law of Raoult, which requires that the vapor-pressure of the smaller component be relatively more reduced than that of the larger component. In the case of the mixtures of methyl alcohol and benzene and of ethyl alcohol and benzene, distillations were made at different pressures (22–77 cms.), the composition of the constant boiling fractions being then found to vary several per cent. In concluding, the author emphasizes the very *common* occurrence of mixtures of constant boiling-point and the consequent frequent impossibility of separating liquids by fractional distillation.

On a Hypothesis to Explain the Partial Non-explosive Combination of Explosive Gases and Gaseous Mixtures. By W. G. MIXTER. *Am. J. Sci.*, 157, 327–334.—The fact that explosions do not occur by sparking explosive mixtures of gases when their pressure is less than a certain limiting value is attributed to the infrequency of impacts of molecules having a velocity or inter-

Digitized by Google

nal energy adequate for chemical union, there being more time in a rare gas than in a dense one for a molecule with energy adequate for combination to lose this energy by radiation.

On the Applicability of the Dissociation Theory to the Electrolysis of Aqueous Solutions Containing Two Electrolytes with a Common Ion. By J. G. MacGregor. *Phys. Rev.*, **8**, 129–140.—The author has calculated from the known dissociation-values and transference numbers of the component salts, the transference relations which should prevail in a mixture of two salts with a common ion, and compares the calculated results with those observed by previous investigators. The agreement is only a rough one. The author calculates the dissociation constants of the salts in question at different concentrations with the help of the ordinary mass-action law, disregarding the now well-established fact that they do not conform to that law.

The Conductivity and Dissociation of Some Electrolytes. By William Foster, Jr. *Phys. Rev.*, **8**, 257–281.—The author has determined the electrical conductivity of solutions of ammonium nitrate, magnesium sulphate, magnesium chloride, sodium ammonium hydrogen phosphate, disodium hydrogen phosphate, and potassium dihydrogen phosphate, of sodium hydroxide, and of phosphoric, oxalic, and citric acids, at concentrations varying from 1.0 to 0.0001 equivalents per liter. The temperature coefficients of conductivity and the specific gravities of normal solutions of these substances were also determined. The degrees of dissociation are calculated for all these substances at the various dilutions and compared with Loomis' results by the freezing-point method. The agreement is close except in the cases of the magnesium salts where differences of 10 to 20 per cent. occur, and of sodium hydroxide and potassium dihydrogen phosphate, where the differences are about 5 per cent.

H. M. Goodwin, Reviewer.

The Electrochemical Equivalents of Copper and Silver. By Theodore W. Richards, Edward Collins, and George W. Heimrod. *Proc. Am. Acad.*, **35**, 123–150.—This valuable contribution to electrochemistry should be read by all interested in the determination of the fundamental electrochemical constant. The investigation was undertaken primarily to reconcile, if possible, the discrepancy existing between the atomic weight of copper as determined by electrochemical and by purely chemical methods. A very careful study was first made of the conditions to be observed in a copper voltameter, and the effect of the various sources of error introduced by variable current density, acidity of solution, etc., is minutely discussed. A number of experi-

Digitized by Google

ments in which two copper voltameters with electrodes of 50 sq. cm. and 25 sq. cm. surface respectively, in series with two silver voltameters, gave the following results for the electrochemical atomic weight of copper :

Uncorrected results of Rayleigh, Gray, Shaw, Vanni, etc	63.30 to 63.50
Large plates in cupric solutions at 20°	63.47
" " " " " " 0°	63.525
Small " " " " " 0°	63.547
Medium " " cuprous " " 0°	63.573
" " " " " " 60°	63.615
Corrected results for cupric solutions	63.563
At. wt. copper by chemical processes	63.604
Discrepancy	0.041

The experiments designated "in cuprous solutions" were made with copper sulphate which had been, by previous electrolysis with an alternating current, saturated with cuprous salt ; they were carried out to determine the maximum value for the electrochemical atomic weight, since if any cuprous ions carry a part of the current the deposit should be too great. The increase in value with rise of temperature (producing increase in solubility of cuprous salt) proves this to be the case, so that 63.573 can be taken as an extreme upper limit. The discrepancy between the chemical and electrochemical atomic weight is thus seen to be greater than the experimental error of either determination, and the authors therefore sought the cause in the silver voltameter. By a very careful investigation of this they were able to show that the effect well known to previous investigators that the deposit of silver in a silver voltameter depended on whether the solution had been previously used or not, arose from the formation of a substance in the neighborhood of the silver anode, which tended to deposit too much silver if allowed to diffuse to the cathode. The form of silver voltameter was therefore changed, the anode being placed within a porous cell, and this compared with Lord Rayleigh's and Patterson and Guthe's form of voltameter. In all cases the new form of voltameter gave the lowest results. The difference amounted to 0.081 per cent. Correcting the atomic weight of copper referred to the ordinary silver voltameter by this amount the authors find its value must lie between 63.598 and 63.615 as outside limits. The chemical value 63.604 lies between these values, in truth, "a remarkable confirmation of the results of the porous cup voltameter." The mean of the corrected values of Lord Rayleigh and Mrs. Sidgwick, F. and W. Kohlrausch, Kahle, and Patterson and Guthe gives 0.0011173 gram silver per ampere second, or 0.0011172 as the mean of the extreme values. On

Digitized by Google

this latter basis one gram equivalent of an electrolyte transports 96610 coulombs of electricity instead of 96540, the value usually assumed. The investigation furnishes probably the most rigid experimental proof of Faraday's law yet published.

The Influence of Temperature, Pressure, Used Solutions, and Size of Anodes on the Deposit of Silver Voltameters. By J. F. MERRILL. *Phys. Rev.*, 10, 167–175.—Pressures up to 103 atmospheres had no effect on the amount of silver deposited, nor did a variation of temperature from 0° to 90° C. The results with five old solutions compared with freshly prepared solutions showed the deposit to be greater from the former by about 1 part in 11600. Later, the old solution, after being repeatedly used, gave an increase of as much as one part in 1700. The solution did not become acid, however, if it had been boiled. The size of the anodes, except in extreme cases, has no appreciable influence. The nature of the surface of the cathode seems to have a slight effect.

The Influence of Electrification upon the Surface Tension of Water and Mercury. By ERNEST MERRITT AND SAMUEL J. BARNETT. *Phys. Rev.*, 10, 65–74.—The authors show by a careful theoretical discussion of the method employed by Barnett for determining the effect of electrification on the surface-tension of water and mercury (*Phys. Rev.*, 6, 257, 1898) that the effects observed can be wholly accounted for by purely electrostatic effects, and that therefore no effect of pure electrification upon surface-tension has yet been observed. The electro-capillary phenomena of mercury in contact with electrolytes are, of course, not here considered.

Polarization and Internal Resistance of Copper Voltameter. By B. E. MOORE. *Phys. Rev.*, 10, 34–52.—By a somewhat elaborate system of circuit breaking and making devices, for details of which reference must be made to the original, the author has measured the total polarization produced by direct currents at the electrodes of a copper voltameter, at times varying from 0.00006 second to 0.045 second after the polarizing electromotive force has been removed. The results are discussed graphically, and the author concludes that, if the true maximum value of the polarization (P) could be measured, the simple formula $r = \frac{E-P}{i}$ would give very nearly the true value of the resistance (r) of electrolytes for all current strengths.

The Electrolytic Reduction of Potassium Chlorate. By ADOLPH L. VOEGE. *J. Phys. Chem.*, 3, 577–601.—The reduction of this salt was experimentally studied under as varied con-

Digitized by Google

ditions as possible, and the following conclusions reached: The reduction is greater in acid than in alkali solution, and varies with the strength of acid; it increases greatly with the temperature, and increases also with decreasing current density; this last influence, however, varies with the nature of the metal used for the electrodes, copper, zinc, cadmium, and platinum having been studied.

The Electrochemical Equivalent of Carbon. By H. C. Pease. *J. Phys. Chem.*, 4, 38–41.—The mean of five experiments on the loss of weight of a carbon anode in fused potassium hydroxide in an electrolytic cell with an iron cathode gave 3.32 as the equivalent weight of carbon. Coehn found the value in sulphuric acid to be 3.0. Carbon thus comports itself in these electrolytes as a quadrivalent element.

On the Inversion of the Hepta- and Hexahydrates of Zinc Sulphate in the Clark Cell. By H. T. Barnes. *J. Phys. Chem.*, 4, 1–21.—The paper contains the complete results of experiments published by Callendar and Barnes in 1897 (*Proc. Roy. Soc.*, 62, 150) on the change of hydration of zinc sulphate crystals indicated by the change in temperature coefficient of a Clark cell in the neighborhood of 39° C. The temperature coefficient of cells of various forms was measured from 15° to 50°, and formulæ for the electromotive force deduced for various intervals. The electromotive force curves for cells containing the hepta- and hexahydrates of zinc sulphate cross at 38.78° C., which therefore corresponds to the transition temperature. From solubility experiments the transition temperature is 39.95°. The difference is explained by a secondary influence due to the presence of the mercurous sulphate in the Clark cell.

The Electrolytic Deposition of Brass. By J. Livingston R. Morgan. *J. Am. Chem. Soc.*, 22, 93–99.—An attempt to explain the process of brass plating on the basis of the osmotic theory of the cell. The explanation does not seem clear to the reviewer, and is not verified by any experimental data.

The Specific Gravity and Electrical Resistance of Metallic Tellurium. By Victor Lenher and J. Livingston R. Morgan. *J. Am. Chem. Soc.*, 22, 28–31.—The tellurium was prepared by reducing an alkaline solution of the oxide by means of sugar (Lenher). For the specific gravity of the powdered metal 6.1993 was found as a mean of three determinations at 20°. The specific resistance was determined by casting the metal in rods of various lengths (57.5 mm. to 162 mm.) and diameters (2.92 mm. to 8.89 mm.) and measuring their resistance by the usual bridge method. Contact was made by means of mercury.

Digitized by Google

The values obtained for the specific resistance vary from about 300 to 1150; the mean, about 500, is only about one-fourth of the value found by Matthieson.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

The Iodometric Determination of Small Quantities of Carbon Monoxide. BY LEONARD P. KINNICUTT AND GEORGE R. SANFORD. *J. Am. Chem. Soc.*, **22**, 14–18.—The carbon monoxide is passed over iodine pentoxide at a temperature of 150°, and the reduced iodine is collected in a potassium iodide solution and titrated with thiosulphate solution. Accurate determinations were made when the amount of the monoxide in the air was as small as 2.5 parts in 100,000.

The Volumetric Determination of Magnesia. BY JAMES OTIS HANDY. *J. Am. Chem. Soc.*, **22**, 31–39.—The precipitate of magnesium ammonium phosphate, thrown down under definite conditions, is collected upon a filter, washed with dilute ammonia, and the filter exposed to the air until the ammonia has volatilized, which is found to be the case when the filter has dried about one-half inch from its circumference. The precipitate and filter are then treated with standard sulphuric acid in excess, and after complete solution the excess is determined by titration with standard sodium hydroxide solution, using methyl orange as an indicator.

Notes: The Retention of Moisture by Asbestos, and The Determination of Graphite by Loss. BY GEORGE AUCHY. *J. Am. Chem. Soc.*, **22**, 46–48.

The Determination of Sulphur in Bitumens. BY A. C. LANGMUIR. *J. Am. Chem. Soc.*, **22**, 99–102.—The author comments upon the criticisms made by S. F. and H. E. Peckham (*this Rev.*, **5**, 100) upon an article by E. H. Hodgson (*this Rev.*, **5**, 10). He prefers the Eschka method as modified by Heath (*this Rev.*, **4**, 121). While it is undoubtedly true that the sulphur in illuminating gas is often a source of considerable error in sulphur determinations, it seems to the reviewer doubtful whether the data given by von Meyer and quoted by Langmuir are of general application. It is certainly true that Boston gas, for instance, introduces much less sulphuric acid during evaporations, even under unfavorable conditions, than was found by von Meyer in his laboratory.

Digitized by Google

The Determination of Nickel in Nickel Ores. By A. C. LANGMUIR. *J. Am. Chem. Soc.*, **22**, 102–106.—The ore is dissolved in nitric acid, this acid replaced by hydrochloric acid, the copper thrown out as sulphide, and the iron oxidized and precipitated once by ammonia. This precipitate is dissolved in hydrochloric acid, and the solution extracted with ether to separate most of the iron, the remaining iron being twice precipitated by ammonia. The ammonium chloride in the filtrate is destroyed by boiling with nitric acid, and finally the solution is evaporated with sulphuric acid, made ammoniacal, and electrolyzed. The procedure given is an adaptation of well-known methods to the special case of nickel ores.

Substitutes for Hydrochloric Acid in Testing Carbonates. By JOSEPH W. RICHARDS AND NORMAN S. POWELL. *J. Am. Chem. Soc.*, **22**, 117–121.—With the purpose of obtaining a substitute for hydrochloric acid in the test for carbonates in field-work the authors studied the action of solutions of potassium acid sulphate, oxalic, citric, and tartaric acids upon various natural carbonates. Tartaric acid proved to be most efficient, followed by citric and oxalic acids. A table shows the effect of each reagent upon a variety of carbonates at varying temperatures.

Report of Committee on Coal Analysis. By WILLIAM A. NOYES, W. F. HILLEBRAND, AND C. B. DUDLEY. *J. Am. Chem. Soc.*, **21**, 1116–1132.—This is a final report of the committee and describes the procedures which they consider efficient for coal analysis.

W. H. WALKER, REVIEWER.

The Constitution of the Magnesium Ammonium Arseniate of Analysis. By MARTHA AUSTIN. *Am. J. Sci.*, **159**, 55–61.—When magnesium ammonium arseniate is formed by the addition of magnesia mixture to a solution of arsenic acid, the presence of an excess of ammonium chloride causes a replacement of some of the magnesium by ammonium, forming possibly the salt $Mg(NH_4)_4(AsO_4)_2$. A precipitate of the ideal constitution is thrown down, however, when an amount of the ammoniacal magnesia mixture slightly in excess of that theoretically necessary to precipitate the arsenic present is added to the faintly acid solution of arsenic acid, containing no ammonium salt, in a volume not exceeding 200 cc. This precipitate may be washed with a faintly ammoniacal wash-water and ignited to pyroarseniate without appreciable loss.

On the Estimation of Thallium as the Acid and Neutral Sulphate. By PHILIP E. BROWNING. *Am. J. Sci.*, **159**, 137–

Digitized by Google

138.—The suggestion of previous investigators that both the acid and neutral sulphates of thallium might be used in the estimation of this element has been carried out by the author with positive results. By treating thallium chloride with sulphuric acid and heating to constant weight at 220°–240° C., the salt was found to correspond to the acid sulphate. When heated to dull redness, sulphuric acid escaped, and when constant weight was again attained, the residue had the composition of the neutral sulphate.

Laboratory Notes. By J. M. Camp. *Iron Age*, 65, 17–18.—In these notes are included detailed directions for the determination of phosphorus in coal and coke, and in ores, pig-iron, and steel which contain also arsenic. A method for the estimation of alumina in slags and ores is proposed, in which the aluminum is separated and weighed as aluminum phosphate.

Silicon in Ferrosilicon. By F. W. Bauer. *Iron Age*, 65, 3.—The percentages of silicon in a sample of ferrosilicon as reported by eleven chemists, working independently, are given, together with an outline of the method used by each. The results vary from 14.90 per cent. to 16.68 per cent. silicon.

A Rapid Method for Determining Lime in Blast-furnace Slags. By Titus Ulke. *Eng. Min. J.*, 69, 164.—The sample of slag is dissolved in very dilute nitric acid, and any barium present is precipitated by the addition of a few drops of sulphuric acid. The solution is now made almost neutral with dilute ammonia, and the calcium precipitated by the addition of ammonium oxalate. This precipitate contains no iron or aluminum, and can be washed free from ammonium oxalate, dissolved, and oxidized with standard potassium permanganate solution. The entire analysis may be completed in from 15 to 20 minutes.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

M. L. Fuller, Reviewer.

Some Analyses of Italian Volcanic Rocks, II. By Henry S. Washington. *Am. J. Sci.*, 159, 44–54.—1. Ciminite. From a trachytic flow at Monte Cimino, Viterbo. The mineral components of this rock as computed from the analyses are orthoclase 37.9 per cent., labradorite 26.5, diopside 16.5, olivine 17.3, and magnetite 1.8. This would place the rock between the trachytes and the andesites and basalts in the group of andesitic trachytes or trachydolorites of Rosenbusch (latite of Ransome). 2. Selagite. This is a lamprophyric latite occurring as a volcanic neck in Tertiary marls, Monte Catini, Tuscany. The analyses

Digitized by Google

are almost identical with those of ciminite, though the diverse conditions of consolidation have resulted in the formation of a different set of minerals; the selagite carrying less olivine, orthoclase, and a plagioclase of less lime, but containing at the same time more augite and an abundance of biotite. It affords a good illustration of the tendency of the complex biotite molecule to crystallize as biotite in intrusions while it splits up into olivine, orthoclase, leucite, etc., in extrusions. Compared with biotite-vulsinite, selagite shows the additional presence of olivine, the available supply of MgO in the magma of the former being exhausted by the crystallization of the biotite and augite. The chemical relations of selagite to venanzite, madupite, wyomingite, and orendite are also discussed. 3. Andesite. From a volcanic neck in Pliocene marls, Radicofani, Tuscany. The new analyses lead the author to consider the rocks examined as basic andesites rather than ciminites, as he has previously held. 4. Leucitite. From a surface flow at Capo di Bove, Alban Hills. Calculations based upon the analyses, aided by physical examination, give the probable mineral composition as leucite 52 per cent., nephelite 10, melilite 17, diopside 17, and magnetite 4. Comparison is made between the composition of the leucitite in question and that of Bearpaw Mt., Montana, and also with venanzite.

Mineral Resources of the Province of New Brunswick. By L. W. Bailey. *Geol. Surv., Canada, Ann. Rep.*, 10, Part M, 1–128.—In addition to exhaustive statistics, some twenty analyses, including magnetite, graphite, limestone, gypsum, mineral waters, and ores of antimony and manganese, are given.

Annual Report for Section of Mineral Statistics and Mines. By E. D. Ingall. *Geol. Surv., Canada, Ann. Rep.*, 10, Part S, 1–230.—A considerable portion of the report is devoted to the iron ores. Ten analyses of the chromic iron ores of Quebec, and over 150 analyses of the Nova Scotia ores, are given. Of the latter, some 50 are published for the first time.

Illinois Gulch Meteorite. By H. L. Preston. *Am. J. Sci.*, 159, 201–202.—This meteorite was found some 4 feet below the surface in Deer Lodge County, Montana, and measured 63 × 104 × 105 mm. A physical examination showed the presence of troilite and a dark steel-gray crystalline mineral supposed to be rhabdite. The analysis of the ground mass showed the presence of 92.51 per cent. of iron, 6.70 per cent. of nickel, and small amounts of cobalt, phosphorus, carbon, and silica.

Granodiorite and Other Intermediate Rocks. By Waldemar Lindgren. *Am. J. Sci.*, 159, 269–282.—This paper has

Digitized by Google

in view the fixing of the position of granodiorite in relation to allied granitic rocks. A somewhat detailed consideration of its chemical and mineralogical composition is given, accompanied by a discussion of its relations to granite, diorite, monzonite, tonalite, banatite, etc. The conclusions reached are that the granodiorite is to be considered as a granular rock with, perhaps, an average composition of quartz 23 per cent., soda-lime feldspars 44 per cent., alkali feldspars 8 to 20 per cent., and ferro-magnesian silicates 14 per cent. The family is regarded as being clearly defined, and is of wide distribution along the Pacific slopes of the Cordilleran ranges.

Two New American Meteorites. By H. L. Preston. *Am. J. Sci.*, **159**, 283–286.—The first of the meteorites described was found at Luis Lopez, New Mexico, and weighed 6.9 kilograms. The sections showed nodules of troilite, streaks and seams of troilite and schreibersite, and rhomboidal patches of plessite composed of alternating layers of kamacite and tænite. The surface was covered with a somewhat lustrous reddish brown crust and was deeply pitted. The analysis showed 91.312 per cent. of Fe, 8.170 per cent. of Ni, and small amounts of Co, P, S, and C. The second of the meteorites, which came from central Missouri, probably weighed about 25 kilograms and is of the same general character as the preceding. The analysis differed from the former in having some 3.42 per cent. more iron and 3.55 per cent. less nickel, the other constituents being nearly the same in both.

Coal Analyses. By George Hall Ashley. *Dept. Geol. and Natural Resources of Indiana, Ann. Rep.*, **23**, 1565–1573.

Geology of Story County, Iowa. By S. W. Beyer. *Iowa Geol. Surv., Ann. Rep.*, **9**, 155–237.—Sanitary and chemical analyses, together with the probable mineral combinations, are given for certain of the artesian waters occurring in the county.

Geology of Scott County, Iowa. By W. H. Norton. *Iowa Geol. Surv., Ann. Rep.*, **9**, 389–519.—Several analyses of artesian waters from the Galena, Saint Peter, and underlying formations are included in this report.

Artesian Wells of the Belle Plaine Area, Iowa. By H. R. Mosnat. *Iowa Geol. Surv., Ann. Rep.*, **9**, 521–562.—The discussion is mainly geological but a number of analyses are given.

Minnesota Iron Mining Economically and Statistically Considered. By Horace V. Winchell. *Minn. Geol. Surv., Final Rep.*, **4**, 581–616.—Some 200 analyses of the Lake Superior iron ores for 1898 and 1899 are given. Of these the Gogebic range

Digitized by Google

furnished about 40, Menominee range 40, Marquette 65, Mesabi 45, and Vermilion range 10.

Ore-bearing Schists of Middle and Northern Cape Breton. By J. Edmund Woodman. *Dept. Mines, Nova Scotia, Rep. 1898*, 1–39.—In addition to the description of the ore-bearing schists, the author discusses briefly the question of the origin of the metalliferous minerals, which he regards in general as due to solfataric action.

Coal in Lower Michigan. By Alfred C. Lane. *Mich. Miner*, 1, Nos. 3–10.—This paper is a semi-popular, but thoroughly scienctifi discussion of the origin, occurrence, erosion, disturbance, and economic development of coal in Lower Michigan. In an appendix there are descriptions of the methods of both proximate and ultimate analyses of coals and of the analysis of ash, together with a discussion of the determination of the heating power, both directly and from proximate analyses.

Magmatic Differentiation in the Rocks of the Copper-bearing Series. By Alfred C. Lane. *Bull. Geol. Soc. Am.*, 10, 15–18.—This paper treats of the chemical and mineralogical variations in the effusive flows constituting the copper-bearing rocks of the Lake Superior region, and discusses their causes. A number of analyses of the upper and lower parts of the flows, and of normal and quartziferous basic intrusives are given.

Formation of Dikes and Veins. By N. S. Shaler. *Bull. Geol. Soc. Am.*, 10, 253–262.—1. Dikes. The author divides dikes into (1) those which have followed preexisting joints or bedding planes, and (2) those which have burrowed their way through the rock independently of fracture lines. The many cases in which the former have apparently followed the lines of more difficult rather than those of less difficult passage leads him to reject hydrostatic pressure as the principal cause of the penetration of the molten material. The conclusions reached are that the sudden conversion of the water of the fissures into steam by contact with the molten material of the dike is the true explanation of the opening of the passage ways for the latter. The passages for the material of dikes of the second class are considered to have resulted from the progressive melting and absorption of the walls by the advancing magma. 2. Veins. The author considers that open fissures could not exist at the depths at which ordinary veins were probably formed, but regards the filling as the result of lateral secretion, the walls being pressed backward by the expansive force of crystallization. Veins of this nature, although apparently presented by the author as a new type, belong to a well-recognized class of deposits. Few would agree

Digitized by Google

with the author, however, in going to the extreme of referring so large a proportion of veins to an origin by lateral secretion.

Physiography and Geology of the Region Adjacent to the Nicaragua Canal Route. By C. Willard Hayes. *Bull. Geol. Soc. Am.*, 10, 285–348.—One of the most conspicuous and important of the geological features along the canal route is the rock decay. The types prevailing on the opposite side of the isthmus are widely different, and are the natural result of the climatic conditions. In the Eastern Division there is a heavy rainfall distributed throughout the year, the surface is covered by dense forests, and the soil and rock are thoroughly saturated with water. As a result, the decomposition extends to great depths. The resulting soils present a deep red color near the surface, but graduate downward, first through a blue clay, then through the soft rock (saprolite), and finally into the undecomposed rock at the bottom. In the Western Division the wet and dry seasons alternate. During the dry season numerous cracks are formed in the soil by shrinkage. Into these cracks a considerable quantity of vegetable matter finds its way, and, upon the return of the wet season and the closing of the cracks, is incorporated in the soil, where its action is to prevent the oxidation of the iron. The result is that the red colors so characteristic of the Eastern Division are entirely wanting. The rate of weathering is much slower than in the Eastern Division.

Notes on the Drift of Northwestern Iowa. By H. F. Bain. *Am. Geol.*, 23, 168–176.—In connection with attempts to discriminate between the Kansan and the younger glacial deposits, a study was made of the chemical weathering of the drift. Both the older and the younger drifts were derived largely from limestone rocks, but in the older all traces of lime have now been removed by solution, leaving a siliceous, iron-stained mass behind. The difference is sufficiently general to be of value in the correlation of the various Kansan exposures.

Notes on the Cretaceous and Associated Clays of Middle Georgia. By George F. Ladd. *Am. Geol.*, 23, 240–249.—The various Cretaceous and Tertiary clays of the Coastal Plain are described, and a number of chemical and mineralogical analyses made by the author are given.

Origin and Age of Certain Gold "Pocket" Deposits in Northern California. By O. H. Hershey. *Am. Geol.*, 24, 38–43.—The deposits in question are located in Trinity County and vicinity, and occur in a black slate of Jurassic age, which is known locally as "porphyry." Underlying the slates is a great massif of diabase in which the gold often assays as high as $2 or

Digitized by Google

$3 a ton. During Carboniferous times this mass was exposed to the atmospheric agencies and was deeply eroded by subærial denudation, the insoluble gold accumulating in the resulting soil, especially in the depressions or pockets. During the subsequent subsidence and advance of the sea the gold is assumed to have been further concentrated in the depressions, where it was finally covered by the deposits of slate. The author explains the coarse condition of the gold in the pockets as compared with that in the veins and amygdules as probably due to the combination of many separate grains through fusion, brought about by the friction, etc., accompanying the metamorphism of portions of the slate.

The Gold-bearing Formation of Stephenson County, Ill. By Oscar H. Hershey. *Am. Geol.*, **24**, 240–244.—The gold, which is not present in economic quantities, occurs as impregnations in one or more strata of the Utica series. The author considers the material to have been in a finely divided and disseminated state in the same or closely adjacent strata, and to have been afterwards concentrated through the agency of solutions traversing the strata laterally.

A Discussion of the Use of the Terms Rock-weathering, Serpentinization, and Hydrometamorphism. By Geo. P. Merrill. *Am. Geol.*, **24**, 244–250.

Notes on the Corundum-bearing Rocks of Eastern Ontario, Canada. By Willet G. Miller. *Am. Geol.*, **24**, 276–282.—The corundum occurs in four different igneous rocks: syenite, syenite pegmatite, nepheline syenite, and anorthosyte. A number of analyses of the anorthosyte, one of which is new, and new analyses of bytownite and hornblende are given.

Some Further Notes on the Weathering of Diabase in the Vicinity of Chatham, Virginia. By Thomas L. Watson. *Am. Geol.*, **24**, 355–369.—The paper presents the results of a careful study of the nature and results of the weathering of diabase. A considerable number of analyses of both fresh and decomposed rocks are given. The tabulated results show a loss in weathering of from 14.93 per cent. (diabase from Medford, Mass.) to 70.31 (olivine diabase from Chatham, Va.). In the decomposition of the Chatham diabase, iron is the constant factor, the alumina which is often selected as the factor, showing in this case a distinct loss.

The Blue Mound Quartzite. By Geo. D. Hubbard. *Am. Geol.*, **25**, 163–168.—This quartzite occurs as a capping on Blue and East Mounds, in Iowa and Dane Counties, Wisconsin, and

Digitized by Google

is probably to be regarded as a remnant of a stratum once continuous over most of the southwestern portion of the state. The author considers the stratum to be the remnant of a highly siliceous Niagara limestone, the calcareous matter of which has been removed by solution, the silica at the same time being deposited in the compact form which it now presents.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. No. 6.

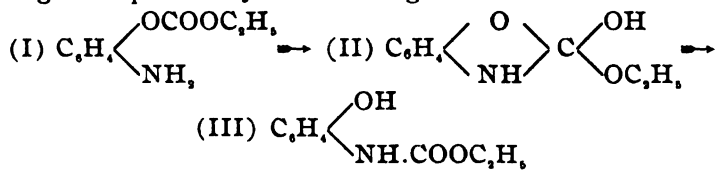
ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

On the Molecular Rearrangement of *o*-Aminophenylethyl Carbonate to *o*-Oxyphenylurethane. BY JAMES H. RANSOM. *Am. Chem. J.*, 23, 1-50.—When *o*-nitrophenylethyl carbonate is reduced in alcoholic solution with tin and hydrochloric acid, a white crystalline compound is obtained, which melts at 86° and not at 95° as given by Bender (*Ber.*, 19, 2268). As the compound is insoluble in acids, it seemed probable that the constitution which had been assigned to it, aminophenylethyl carbonate, was incorrect. The author, accordingly, undertook a thorough investigation of the reaction, and has shown that Bender's compound is identical with *o*-oxyphenylurethane prepared from *o*-aminophenol and ethyl chlorformate. By effecting the reduction of the nitro compound at a low temperature, an oil, soluble in acids, was obtained, which proved to be *o*-aminophenylethyl carbonate. This compound readily suffered rearrangement into *o*-oxyphenylurethane. This change was studied carefully, as it seemed probable that an intermediate product was formed in the reaction. This compound would be of interest on account of the fact that it could be an addition-product of an amine and an ester, and would, therefore, throw light on the reaction between compounds of these classes. The change is expressed by the following formulae:



Digitized by Google

Formula (II) represents the constitution of the hydroxide base corresponding to the hydrochloride of ethoxymethenylaminophenol (an imido ester), if the salts of the imido esters are formed by the addition of the acid to the double bond between the carbon and nitrogen atoms. The isolation of such a compound would be of value in deciding the structure of such salts. The compound was not obtained, but the author is of the opinion that it was formed during the transformation for the following reasons: *p*-aminophenyl carbonate was found to be a perfectly stable compound, the rearrangement being peculiar to the ortho series, and, further, the rearrangement occurs only as long as the nitrogen atom holds at least one hydrogen atom. In order to determine whether the structure of the compound formed by the reduction of *o*-nitrophenylethyl carbonate is represented by formula (II) or formula (III), the action of acyl chlorides on it was studied. By the action of benzoyl chloride, a compound was readily obtained, which was identical with the substance formed by the action of ethyl chlorformate on benzoyl-*o*-aminophenol. This fact indicates that the benzoyl ester is a derivative of a substance of formula (II), but since a molecular rearrangement of aminoethylphenyl carbonate was proved, the structure was investigated from another point of view. The benzoyl ester of oxyphenylurethane is insoluble in alkalies, and has the ring structure. If the methyl ester has an analogous structure, it should exhibit the same reactions. The methyl ether was prepared from methylaminophenol and ethyl chlorformate, and also from oxyphenylurethane by direct methylation by means of diazomethane. The ester was soluble in alkalies, and was, accordingly, a derivative of a compound of formula (III). Since it has been shown that diazomethane can be used to determine delicate questions of constitution, the methyl group being introduced with such ease, it follows that formula (III) represents the structure of the compound formed from *o*-nitrophenylethyl carbonate by reduction. A careful study of the relation between the ring compound (formula II) and the hydrochloride of ethoxymethenylaminophenol was not made, but it was shown that the salt gives by hydrolysis oxyphenylurethane under the same conditions that aminophenylethyl carbonate does. This reaction is further evidence in favor of the view of the structure of the salts of imido ethers put forward by Stieglitz (*Am. Chem. J.*, 21, 108). Benzoyloxyphenylurethane (m. p. 75°.5) was prepared from benzoylchloride and oxyphenylurethane, and also from benzoyl-*o*-aminophenol and ethylchlorformate. It is insoluble in acids and alkalies, can be saponified, and yields, on dry distillation, alcohol, benzoylaminophenol, ethylbenzoate, and benzoyl carbonyl-*o*-aminophenol. The latter compound (m. p. 174°) was also prepared from carbonylaminophenol. Analogous compounds

Digitized by Google

containing the nitrobenzoyl group were prepared. Carbethoxy-aminophenol phenyl carbamate, prepared from the phenol, phenyl isocyanate, and aluminum chloride melts at 116°–118°. Carbonylmethyl-*o*-aminophenol, $CH_2.N.C_6H_4OCO$, was prepared from the phenol and methyl iodide. It melts at 86°, and when heated with concentrated hydrochloric acid at 180°, yields *o*-methylaminophenol (m. p. 88°–90°) which with benzoyl chloride forms an ester (m. p. 160°–162°), and with ethyl chlorformate gives benzoylmethyl-*o*-aminophenylethyl carbonate (m. p. 68°). *o*-Oxyphenylmethylurethane, prepared from methyl-*o*-aminophenol and ethyl chlorformate, melts at 53° and yields a benzoyl derivative which melts at 88°–90°. From anisidine and ethyl chlorformate, *o*-methoxyphenylurethane (b. p. 180–182° at 26 mm.) was prepared. By bromination a monobrom derivative (m. p. 102°.5) and a compound melting at 252° were formed. By the action of phosphorus pentachloride, a chloride was obtained, which was converted into *o*-anisidine urea (m. p. 143°–145) by ammonia, and into the corresponding phenyl derivative (m. p. 144°) by aniline. *o*-Aminophenylethyl carbonate is an oil, and forms a hydrochloride (m. p. 150°–152°), which forms a double salt with platinum chloride. *p*-Nitrophenylethyl carbonate melts at 68° and is converted into an amido compound (m. p. 36°) on reduction, which gives a hydrochloride (m. p. 197°) and a double chloride containing platinum (m. p. 237°). *p*-Aminophenylethyl carbonate was converted into the corresponding urea (m. p. 147°–150°), but a transformation similar to that which took place with the ortho compound could not be brought about.

Products of the Explosion of Acetylene. By W. G. Mixter. *Am. J. Sci.*, **159**, 1–9.—The explosion of acetylene was studied in order to test the hypothesis advanced by the author, that a sufficient frequency of molecular impacts is requisite to secure spread of explosive change throughout a gas. The gas was introduced into glass tubes 20 cm. long and 11–15 mm. internal diameter at ordinary temperature and pressure. The tubes were then sealed and heated in a furnace. When the desired temperature was reached, the gas was exploded by an electric spark produced between platinum wires sealed in the tubes. In no case was the explosion violent. The hydrogen remaining after absorbing acetylene was the measure of the decomposition; the difference between the volume of acetylene taken and the volume of gas after explosion was considered a measure of the condensation-products formed. As the result of fifteen experiments it was shown that at 325°, decomposition did not extend throughout the gas, although the energy of the system was greater than

Digitized by Google

that containing twice as many molecules at 0° in the same space —a condition in which decomposition will propagate itself. At temperatures above 325° the decomposition was self-propagating, as the impacts were of sufficient frequency to cause explosion. The results at high temperatures present the striking fact that the amount of acetylene decomposed, as measured by the residual hydrogen, is fairly constant from 350° to 450°. At 447° 50 per cent. of the acetylene was decomposed and 20 per cent. was condensed. When acetylene was exploded under conditions allowing expansion, in a tube 10 mm. in diameter, at the temperature of the room, and under a pressure of 3 atmospheres, the explosion was violent and 79 per cent. of the gas was decomposed and 5 per cent. was condensed. When the explosion took place in a bomb where no change in volume was possible, the residual acetylene amounted to almost 4 per cent. The decomposition into carbon and hydrogen in this case was probably complete. The acetylene present after the explosion was no doubt formed from its elements at the high temperature reached in the decomposition. In the experiments in which the acetylene contained a trace of air, the presence of hydrocyanic acid was noted.

Camphoric Acid. By William A. Noyes. *Am. Chem. J.*, **23**, 128-135.—The author suspected that the ketone prepared from dihydrociscampholytic acid (*this Rev.*, **5**, 127) was 2,3,3-trimethylcyclopentanone, and, accordingly, undertook the preparation of the latter compound by a synthesis which would leave no doubt as to its structure. This synthesis has been completed with the result that the two compounds are proved to be identical. It follows from this fact that ciscampholytic acid is Δ'-2,3,3-trimethylcyclopentenoic acid, and that the older formula of Perkins for camphoric acid and Bouveault's formula for camphor are correct. γ-Bromisocaproic acid was condensed with the sodium derivative of methylmalonic ester. From the resulting ester of 2,3,3-tetramethylhexoic 1,2',6-acid (b. p. 180°–187° at 20 mm. pressure) the free acid ($HOOC)_2C.CH_2.C(CH_3)_2.CH_2.CH_2.COOH$) was prepared, which crystallizes from ether in needles, which begin to decompose at 175° and give a quantitative yield of $\alpha\beta\beta$-trimethyladipic acid when heated at 190°–200°. The trimethyladipic acid, when distilled from lime, was converted into a ketone which yielded an oxime (m. p. 104°) identical with the one from the ketone prepared from α-hydroxydihydrociscampholytic acid. The author gives his reasons for his opinion that camphonic acid is a normal γ-lactone.

On the Rearrangement of Imido-esters. By Henry L. Wheeler, Treat B. Johnson, Munson D. Atwater, and

Digitized by Google

BAYARD BARNES. *Am. Chem. J.*, 23, 135–150.—A distinct part of the work described in this article was done by each of the four authors. In this review a separate paragraph, preceded by the author's initials, is devoted to the work of each.

H. L. W.—Imidoesters react slowly at ordinary temperatures with methyl and ethyl iodides, giving alkylamides. This reaction is accompanied by the formation of hydrogen iodide, which with unaltered ester gives a primary amide, and by a decomposition of part of the ester into nitril and alcohol. The products identified as the result of the action of methyl iodide on benzimidoethyl ester were methylbenzamide, benzamide, benzonitril, and a trace of cyanphenin. The result was the same at room temperature or at 100°, and in the presence of a small or large amount of methyl iodide. Ethyl iodide gave a similar result. A search was made for diethylbenzamide in the reaction-product, but without success. Benzimidoisobutyl ester and methyl iodide gave isobutyl iodide and methylbenzamide. Benzimidoisobutyl ester and isobutyl iodide gave benzonitril, benzamide, and isobutylene. In order to determine the properties of isobutylbenzamide, which was expected as a product of the above reaction, it was prepared by the Baumann-Schotten reaction, and found to be an oil which boiled at 173°–178° at 13 mm. pressure and formed crystals which melted at 57°–58°.

T. B. J.—A quantitative study of the reaction between phenylacetimidomethyl ester and methyl iodide showed that the amount of transformation taking place was independent of the quantity of methyl iodide used. The weights of phenylacetamide, phenylacetonitril, and methylphenylacetamide from 20 grams of the imidoester were approximately 2, 4, and 6 grams, respectively. Ethylphenylacetamide crystallizes from water in colorless plates, which melt at 73°-74°.

M. D. A.—Furimidomethylester was prepared from furyl cyanide; it boils at 52°–57° at 8 mm. and at 169°–172° at 762 mm. pressure. The behavior of this ester with methyl iodide is analogous to that of the other imidoesters. Methylpyromucamide, prepared by this reaction, melts at 64°. *p*-Tolenylimidomethylester (b. p. 105°.5 at 10.5 mm. pressure) suffered a transformation with methyl iodide similar to those described above. *β*-Naphthylimidoethylester was also prepared, and showed a similar reaction with ethyl iodide.

B. B.—Experiments with silver succinimide and methyl and ethyl iodides showed that the oxygen esters, which are first formed as products of the reaction, are converted by the alkylhalide into nitrogen esters. The results are therefore in accord with the facts described above. As an example of an acylimido ester benzoylbenzimidoester was studied. This compound suf-

Digitized by Google

fered no transformation with ethyl iodide, but when heated to 200° was decomposed into benzonitril and ethylbenzoate.

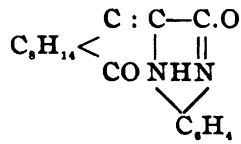
Anethol and Its Isomers. By W. R. Orndorff and D. A. Morton. *Am. Chem. J.*, 23, 181–202.—The authors have subjected the work on anethol and fluid metanethol to a careful revision and find that the two substances are identical. In odor, taste, boiling-point (233°.5), melting-point (22°5), specific gravity, and crystal form, the pure products exhibit no differences. Both substances show exactly the same chemical conduct. They yield the same dibromide (m. p. 63°–64°), monobrom dibromide (m. p. 102°), hydrochloride, picrate (m. p. about 70°), nitrosite (m. p. 130°), nitrosite anhydride (m. p. 98°), and nitrosochloride (m. p. 123°). A compound of the formula $C_{10}H_{12}O.C_6H_6OH$ is formed by the action of alcoholic potash on anethol hydrochloride. The compound is a liquid, which distils with steam with slight decomposition. When distilled alone it breaks down completely yielding alcohol, anethol, and higher-boiling products. Anethol gives a hydrobromide analogous to the hydrochloride. When decomposed by alcoholic potash and distilled, it yields, as chief products, anethol and isoanethol. When an alcoholic solution of anethol was treated with sodium, *p*-propylanisol was formed. Anethol is rapidly and completely converted into anisoin when it is heated in acetone solution with iodine. *p*-Cresol was isolated as one of the products of the destructive distillation of anisoin.

Condensation Compounds of Amines and Camphoroxalic Acid. By J. Bishop Tingle and Alfred Tingle. *Am. Chem. J.*, 23, 214–230.—In a previous paper (*this Rev.*, 5, 67) the authors described the action of aniline on camphoroxalic acid. The work has been extended to the study of the action of other amines on the acid, and the results show that the products of the reaction when fatty amines are used are not analogous in structure to those obtained from aromatic amines. This difference in behavior is probably due to the great difference in basicity of the two classes of amines. In the present paper the action of α- and β-naphthylamine, *o*-phenylenediamine, and semicarbazide on camphoroxalic acid is described. By the action of α-naphthylamine on the acid, in alcoholic solution at 100°, a compound was obtained which crystallizes from benzene in amber-colored crystals, and melts at 170° with decomposition. The compound resembles the aniline derivative prepared in an analogous way and probably has the following structure:

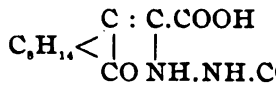
$$C_8H_{14}\begin{cases} C : C.COOH \\ | \quad | \\ CO\ NH.C_{10}H_7 \end{cases}.$$

Digitized by Google

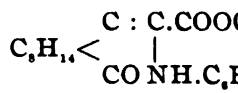
β-Naphthylamine gives a similar compound (m. p. 173°). *o*-Phenylenediamine readily condenses with the sodium salt or ethyl ester of camphoroxalic acid giving a compound (m. p. 246°) to which the following structure is assigned:



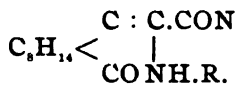
Two substances are formed by the interaction of semicarbazide and potassium camphoroxalate in presence of alcohol at 100°. They are separated by their different solubilities in ether. The soluble compound melts at 218°, the insoluble at 209°–210°. Both have the composition represented by formula



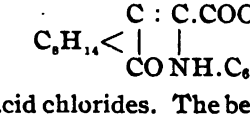
At 100°, in alcoholic solution, ethyl camphoroxalate and aniline yield the compound (m. p. 158°–160°)



Compounds of an analogous composition were obtained from β-naphthylamine (m. p. with decomposition at 174°) and from semicarbazide (m. p. 202°). Ethylcamphoroxalate condenses with ammonia, methylamine, and ethylamine under similar conditions, but the compounds formed have the following structure:



These substances will be described in a later paper. Condensation-products could not be obtained from the ester or salt of camphoroxalic acid and ethylaniline, dimethylaniline, *m*- and *p*-phenylenediamine, or urea. Ethylcamphoroxalate did not react with α-naphthylamine or dimethylaniline. Phenylcamphoformeneamine,

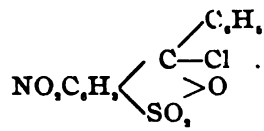


readily reacts with acid chlorides. The benzoyl derivative melts at 160°–161°, the benzenesulphonyl compound at 133°, and the acetyl derivative, which was not obtained in pure condition, at 134°. The formation of acyl derivatives is evidence in favor of the

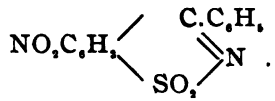
Digitized by Google

view of the structure of the compound represented by the above formula.

The Symmetrical Chloride of Paranitroorthosulphobenzoic Acid. By F. S. Hollis. *Am. Chem. J.*, 23, 233–255.—The author gives much improved directions for the preparation of the chlorides of *p*-nitro-*o*-sulphobenzoic acid. By regulating the conditions under which the acid potassium salt of the acid is treated with phosphorus pentachloride, the resulting product consists of the unsymmetrical chloride only, or of a mixture of the chlorides, which contains 30–40 per cent. of the symmetrical chloride. The two chlorides were separated by crystallization from chloroform. The action of benzene and aluminum chloride on the two chlorides was studied under a variety of conditions. Both compounds yielded the same product, *p*-nitro-*o*-benzoylbenzenesulphone chloride, but one chlorine atom entering into the reaction. The compound crystallizes in monoclinic crystals, and melts at 177°. The author is of the opinion that the chloride has the structure represented by the following formula on account of its high melting-point and the fact that it is not acted upon by alcoholic potash:



By heating with hydrochloric acid, sulphuric acid, water, or absolute alcohol, the chloride is converted into *p*-nitro-*o*-benzoylbenzenesulphonic acid. The barium salt of this acid is of interest, as it crystallizes with three, three and one-half, six, and seven molecules of water of crystallization. The sodium, potassium, magnesium, calcium, and lead salts were also prepared. *p*-Nitro-*o*-benzoylbenzenesulphone chloride, when heated with concentrated ammonia at 100°, gave a lactim of the formula,



The compound is a granular powder (m. p. 234°), which is converted into the ammonium salt of nitrobenzoylbenzenesulphonic acid when heated with hydrochloric acid at 200°.

Stereoisomers and Racemic Compounds. By Herman C. Cooper. *Am. Chem. J.*, 23, 255–261.—Kipping and Pope (*Proc. Chem. Soc.*, 1898, 113) have shown that on allowing a racemic mixture to crystallize from an optically active solvent, the first factions show a preponderance of crystals of one of the

Digitized by Google

isomers. This fact would indicate that the optical isomers had different solubilities in the solvent, but since the author with Goldschmidt (*Ztschr. phys. Chem.*, 26, 711) had found that the two active carvoximes have the same solubility in *d*-limonene, it seemed of interest to investigate the subject further. The sodium ammonium tartrates, the compounds investigated by Kipping and Pope, have the same solubilities in dextrose solutions of varying strength, notwithstanding the fact that they can be separated by crystallization from such solutions. The sodium hydrogen tartrates were investigated with the same result. Sodium hydrogen tartrate decomposes at 234°, the racemate at 219°, and a mixture of equal parts of the optical isomers at 222°. A mixture of approximately equal parts of the active carvoximes melts at 93°, the melting-point of inactive carvoximes. A slight shrinking was observed at 72°, the melting-point of the active body. On mixing equal amounts of the active sodium hydrogen tartrates in water, a cloudy precipitate of racemate appears and does not disappear until the temperature of solution of the racemate is reached. A mixture of the active carvoximes has the same solubility in aqueous alcohol as the inactive variety.

A New Synthesis in the Quinazoline Group. By Marston Taylor Bogert and August Henry Gotthelf. *J. Am. Chem. Soc.*, 22, 129–132.—When anthranilic acid was heated in a sealed tube with acetonitrile, 2-methyl-4-ketodihydroquinazoline was obtained. In this preliminary paper the authors show that this is a general reaction by preparing analogous derivatives from the nitriles of propionic, benzoic, phenylacetic, and *p*-toluic acids. The yields are good, and as the reaction proceeds as readily with aromatic as with fatty nitriles, the synthesis will be of particular value in preparing quinazoline derivatives containing aromatic groups.

A Comparison of Some Formaldehyde Tests. By B. M. Pilhashy. *J. Am. Chem. Soc.*, 22. 132–136.—The author reports the results of a study of the various tests for formaldehyde. It is shown that the test of Trillat with dimethylaniline and sulphuric acid is untrustworthy, since the amine itself gives the color reaction which is said to be due to the aldehyde. The author concludes that phenylhydrazine hydrochloride is the best reagent for detecting formaldehyde.

The Action of *α*-Acylated Phenylhydrazines on the Chlorine Derivatives of Quinones. By William McPherson and Robert Fischer. *J. Am. Chem. Soc.*, 22, 141–144.—Trichlorquinone reacts readily with unsymmetrical benzoylphenylhydrazine and forms a compound of the structure,

Digitized by Google

$$O{:}C\begin{cases} CCl : CCl \\ \quad\quad >C : O \\ CCl : C.NH.NC_6H_4.C_6H_4CO \end{cases}$$

The two atoms of hydrogen which are removed in the condensation, reduce a part of the quinone to the corresponding hydroquinone. This reaction is of interest since hydrazones are formed from quinone and acylated phenylhydrazines. The new compound is a bright red crystalline body which melts at 158°.5.

On the Action of Certain Acid Reagents on the Substituted Ureas. By F. B. Dains. *J. Am. Chem. Soc.*, **22**, 181–198.—The action of a number of acids, acid chlorides, and acid anhydrides on substituted ureas was studied, and in no case was the direct introduction of an acyl group observed. In all cases the temperature required to produce reaction was so high that acyl ureas were never isolated, but only their decomposition-products. The experiments presented show that the reaction between thioureas and organic monobasic acids gives fairly constant results, the products being carbon dioxide, hydrogen sulphide, water, aniline, the anilide, mustard oil, and carbanilide. With dibasic acids and acid chlorides the reaction is more complicated and varied. Reference must be made to the original paper for the large number of details given.

The History of the Constitution of the Alkaloids. By A. R. L. Dohme. *Am. J. Pharm.*, **72**, 9–25.

Racemism. By Robert Hart Bradbury. *J. Franklin Inst.*, **149**, 299–314.—A historical lecture.

BIOLOGICAL CHEMISTRY.

A. G. Woodman, Reviewer.

Preliminary Communication on the Chemistry of Mucin. By P. A. Levene. *J. Am. Chem. Soc.*, **22**, 80–85.—The author has obtained a substance with acid properties from tendomucin, submaxillary mucin, and a mucoid carcinoma. Its chemical properties, as well as the analysis of its copper salt, point to its identity with chrondroitinsulphuric acid. The results of this preliminary investigation seem to show that the mucins in general are not simple compounds of proteids and carbohydrates, but are proteid derivatives of an ethereal sulphuric acid.

On the Maximum Production of Hippuric Acid in Rabbits. By W. H. Parker and Graham Lusk. *Am. J. Physiol.*, **3**, 472–484.—The authors conclude that in metabolism the proteid molecule, the same being likewise true of gelatine, may yield

Digitized by Google

glycocoll to the extent of 3 or 4 per cent., the amount of hippuric acid found being taken as a measure of the formation of glycocoll. The carbohydrates do not increase the formation of glycocoll. Details are given of an improved method for the determination of hippuric acid in urine.

On the Metabolism of Matter in the Living Body. By EDWARD B. ROSA. *Phys. Rev.*, 10, 129–150.—The author has calculated the balance of oxygen and of matter for a four-days' metabolism experiment made with a respiration calorimeter (*this Rev.*, 6, 104). The change in weight of the subject during the 96 hours, which was observed as a check upon the calculations, is shown by graphical representations. Suggestions are also made for an improved method for obtaining the weight of the subject by means of outside observations.

Dietary Studies of Negroes in Eastern Virginia in 1897 and 1898. By H. B. FRISSELL AND ISABEL BEVIER. *U. S. Dept. Agr., Bull.* 71, 1–45.—As a result of these investigations it was found that in the negro families which had come under the influence of educational institutions, such as Hampton and Tuskegee, the diet resembled quite closely that of the ordinary white family under similar conditions. In the other cases studied, the difference was not so much in the amount of nutritive material as in the manner of preparing and serving it. No analyses of food materials are given, the composition being estimated from tables previously published.

Dietary Studies of University Boat Crews. By W. O. ATWATER AND A. P. BRYANT. *U. S. Dept. Agr. Expt. Sta. Bull.*, 75, 1–72.—These studies further emphasize the large amount of energy in the dietaries of athletes and the striking difference in the amounts of protein consumed by them and by ordinary working people. A comparison between the dietaries of the boat crews and the average of fifteen college clubs showed a difference in protein amounting to four and a half times the difference in fuel value. The results tend to confirm the view that men or animals who perform intense muscular work for short periods of time, under more or less nervous strain as well, require a larger supply of protein than under normal conditions of slow, long continued work. It is a question, however, whether under these "normal" conditions a part of the energy is not supplied by fat rather than by protein.

Character and Extent of Food and Drug Adulteration in Massachusetts, and the System of Inspection of the State Board of Health. By ALBERT E. LEACH. *Tech. Quart.*, 13, 22–40.—This article, which does not admit of a brief review, is

Digitized by Google

a rather popular discussion of the extent of adulteration in Massachusetts and of the kind of substances usually adulterated.

Soil Investigations. By HARRY SNYDER. *Minn. Agr. Expt. Sta. Bull.*, 65, 1–84.—This bulletin contains a discussion of the chemical and mechanical composition of certain Minnesota soils, together with an outline of their characteristic features and the measures which the author considers necessary to preserve their fertility.

The Proteids of Wheat Flour. By HARRY SNYDER. *Minn. Agr. Expt. Sta. Bull.*, 63, 519–533.—The author has made a study of the proteids of a number of samples of flour and mill products, following the methods proposed by Osborne and Voorhees (*Am. Chem. J.*, 15, 392), for the separation of the proteids. Among other observations it was found that while the lower grades of flour contain more protein than the high grades, the gliadin and glutenin in the lower grades are not present in the right proportion to form a well-balanced gluten; that is, one which will produce bread of the best physical properties. The gliadin-glutenin ratio in different grades of flour made from the same wheat was found to vary from 25 to 75 in the red dog or lowest grade, to 65 to 35 in the highest. A well-balanced gluten is considered to have this ratio approximately as 65 to 35.

Winter vs. Spring Bran. By WILLIAM FREAR AND W. A. HUTCHINSON. *Pa. State Coll. Agr. Expt. Sta. Bull.*, 48, 1–8.—The analysis of twenty samples shows that the average spring wheat bran is drier than winter wheat bran and contains less starchy matter and appreciably more protein and fat, as well as ash and fiber.

The Feeding Value of Sorghum as Shown by Chemical Analysis. By R. W. THATCHER. *Nebr. Agr. Expt. Sta. Bull.*, 62, 65–72.—Experimental tests have shown that sorghum possesses different feeding values at different stages of growth. A series of analyses made to find the reason for this show that when the plant is young it is deficient in flesh-forming material, being about the same as timothy. An interesting point is the apparent absence of sugar when the seed is sown broadcast instead of in rows.

A Chemical Study of the Apple and Its Products. By C. A. BROWNE, JR. *Pa. Dept. Agr. Bull.*, 58, 1–46.—In this bulletin the author discusses the chemical composition of the apple, the chemistry of its growth and ripening, and the effect of storage. A further discussion is also given of the principal apple products, including evaporated apples, cider, jelly, apple butter, apple

Digitized by Google

pomace, and vinegar. A short bibliography of the most important books relating to the subject is appended.

Experiments with Potatoes. By Chas. D. Woods and J. M. Bartlett. *Me. Agr. Expt. Sta. Bull.*, 57, 145-158.—Experiments have been made with regard to the effect upon the starch content of potatoes of spraying them with Bordeaux mixture. The average amount of starch found in the sprayed samples was 19.06 per cent., and in the unsprayed samples 17.43 per cent.

Cider Vinegar: Its Solids and Ash. By R. E. Doolittle and W. H. Hess. *J. Am. Chem. Soc.*, 22, 218-220.—The solids of pure cider vinegar consist of glycerol, albuminous substances, gums, malic and other organic acids, and mineral matter; they give no rotation with the polariscope and little or no reduction of Fehling solution after clarification with lead acetate. The ash, which should not be less than 0.75 per cent., consists mainly of potash with small amounts of sulphuric and phosphoric acids. A spurious vinegar was found to be composed of dilute acetic acid, glucose, and soda ash; another, of acetic acid, boiled cider, and lime.

The Oregon Prune. By G. W. Shaw. *Ore. Agr. Expt. Sta. Bull.*, 61, 1-18.—This bulletin contains the results of analysis of fresh and cured prunes, showing their proximate composition, food value, and soil draught.

Commercial Fertilizers. *Me. Agr. Expt. Sta. Bull.*, 60, 24-29; *R. I. Agr. Expt. Sta. Bull.*, 60, 39-48; *La. Agr. Expt. Sta. Bull.*, 58, 190-264; *Ky. Agr. Expt. Sta. Bull.*, 85, 79-129; *Wis. Agr. Expt. Sta. Bull.*, 81, 1-8; *N. Y. Agr. Expt. Sta. Bull.*, 173, 531-552; *Vt. Agr. Expt. Sta. Bull.*, 77, 141-147.

ANALYTICAL CHEMISTRY.

PROXIMATE ANALYSIS.

A. G. Woodman, Reviewer.

Foreign Coloring Matter in Milk. By Albert E. Leach. *J. Am. Chem. Soc.*, 22, 207-210.—The principal substances used at present to color milk are annatto, caramel, and yellow aniline dyes. To detect their presence about 150 cc. of milk are curdled by heat and acetic acid and the curd separated as much as possible from the whey. The curd is macerated for an hour or more with ether which extracts only the annatto. If the curd, after pouring off the ether, is not left perfectly white the presence of one of the other colors may be suspected. A portion of the fat-free curd is placed in a test-tube and shaken with con-

Digitized by Google

centrated hydrochloric acid. The gradual formation of a blue color indicates the presence of caramel, the immediate formation of a pink tinge the presence of the aniline color.

A Comparison of Some Formaldehyde Tests. By B. M. Pilhashy. *Pharm. Rev.*, 18, 115–118.—From a study of several qualitative tests proposed for formaldehyde the author finds that in the method proposed by Trillat (*Compt. Rend.*, 116, 891), using dimethylaniline and sulphuric acid, the reaction is due to the excess of dimethylaniline and not to the formaldehyde. He considers the best reagent for formaldehyde to be phenylhydrazine hydrochloride, used either with sulphuric acid and sodium acetate or with sodium nitroprusside and strong caustic soda, the limit of delicacy being about 1 : 250,000 in the first case, and 1 : 1,000,000 in the second. The reviewer would point out, however, that the value of the test is limited by the fact that the reaction is given by furfurol in the first instance, and that acetaldehyde gives a red color which tends to mask the reaction in the second case.

Methods for the Detection of "Process" or "Renovated" Butter. By W. H. Hess and R. E. Doolittle. *J. Am. Chem. Soc.*, 22, 150–152.—The methods proposed are based mainly upon an examination of the curd. The curd of process butter consists mainly of coagulated casein in distinction from the curd of true butter which contains the proteids of the cream. The two kinds of curd may be distinguished readily by the greater amount of albumin found in the "process" butter curd.

The Technical Analysis of Licorice Pastes. By M. Trubek. *J. Am. Chem. Soc.*, 22, 19–21.—The author describes the methods in ordinary use together with the method which he has devised for the determination of glycyrrhicin. The results of analysis are given for fresh and spent licorice root.

The Determination of Glycogen and Relative Quantities of Glycogen in Different Parts of the Flesh of a Horse. By J. K. Haywood. *J. Am. Chem. Soc.*, 22, 85–93.—After trying a number of methods proposed for the determination of glycogen with unsatisfactory results, the following method was settled upon. About 50 grams of the ground meat are digested on the water-bath for six hours with 300 cc. of a one per cent. potassium hydroxide solution. The solution is then made slightly acid, and the proteids completely precipitated by alternate additions of hydrochloric acid and double iodide of potassium and mercury. An aliquot part of the filtered extract is exactly neutralized with potassium hydroxide, three or four drops of strong hydrochloric acid are added, and the glycogen is precipitated by the addition

Digitized by Google

of 95 per cent. alcohol. This is filtered off, washed, dried at 80°–100° C., then at 115°, and weighed. A number of analyses are given showing the amount of glycogen in different cuts of horse meat.

Chemical Methods for Ascertaining the Lime Requirement of Soils. By H. J. Wheeler, B. L. Hartwell, and C. L. Sargent. *J. Am. Chem. Soc.*, **22**, 153–177.—Among a number of methods tried, those which gave results most nearly comparable with the results of field tests on Rhode Island soils were: (1) Treatment of the soil with dilute ammonia and weighing the humus extracted. This method is applicable only when the acidity is due largely to organic matter. (2) A method of titration, based on measuring the number of milligrams of nitrogen, combined as ammonium salts, held by the soil when treated with very dilute ammonia. The results by this method agree quite closely with the results of crop tests. (3) Comparison of the color of a direct ammonia extract of the soil with the color of a similar extract of a soil of known character. This method is rapid and gives fairly good results.

A. H. Gill, Reviewer.

On Hubl's Iodine Method for Oil Analysis. By A. H. Gill and W. O. Adams. *J. Am. Chem. Soc.*, **22**, 12–14.—The authors recommend the use of mercuric iodide instead of the chloride, whereby the formation of chloride of iodine is prevented. The results obtained show a decided decrease in the amount of substitution, nearly the theoretical value being obtained for oleic acid.

On the Determination of Volatile Combustible Matter in Coke and Anthracite Coal. By R. K. Meade and J. C. Attix. *J. Am. Chem. Soc.*, **21**, 1137.—The authors find that by the usual method (of Blair) some carbon is burned. Their study of the matter has led to the following results: The larger the crucible and flame used, the greater the loss; the tighter the joint between cover and crucible, the less the loss; the larger the sample, the less the loss; the fineness and per cent. of ash also exercise some influence. It is suggested that the amount of carbon burned during the heating process can be very closely determined by a second ignition, the difference in weight being the amount burned. This gives results approximating closely to those obtained by ignition in nitrogen or hydrogen.

The Determination of the Bromine Absorption of Oils. By P. C. McIlhiney. *J. Am. Chem. Soc.*, **21**, 1084–1090.—The process resembles that published some years ago by Snodgrass

Digitized by Google

and Mills, except that it is more rapid, and the quantity of bromine both added and substituted is determined. For this purpose the oil is dissolved in carbon tetrachloride, and a measured quantity of one-third normal bromine in the same solvent added; after the reaction is completed, which requires two minutes, the excess of bromine is determined by potassium iodide and thiosulphate. The hydrobromic acid formed by substitution is determined similarly by using potassium iodate. The process seems accurate, easily executed, rapid, and cheap, and should find wide acceptance.

On the Rancidity of Fats. By ISKAR NAGEL. *Am. Chem. J.*, 23, 173–176.—The paper gives the results of some experiments upon rancid fats which were carried on under the late Prof. Benedikt Free fatty acids and hydroxy acids are easily removed by an aqueous solution of water-glass, which completely prevents emulsions. Volatile lactones, alcohols, esters, some aldehydes, acetals and terpenes can usually be removed by distillation with steam. Either steam alone or steam mixed with hydrogen or carbon dioxide, or distillation at 100°–170° with a gas current or at diminished pressure may be employed for the purpose. The non-volatile lactones are boiled with alkali to change them to salts; the aldehydes are removed by the bisulphite method; and the acetals are changed to the alcohols and aldehydes by treatment with sulphuric acid, and these substances are then removed as already explained.

The Analysis of Essential Oils. By CLEMENS KLEBER. *Am. J. Pharm.*, 71, 566–584.—The subject is one requiring a thorough knowledge, especially as the oils contain double-bonded compounds which change rapidly. An example of this change s shown in the case of the oil of cloves, which, when prepared by an improved process in half the usual time, gave an increased yield and finer fragance. It is shown further that an oil prepared in the laboratory where only a seven per cent. yield was obtained, could not be considered as a criterion by which to judge of an oil obtained by a technical distillation in which 18 per cent. was obtained. With each sample of oil should be a statement giving: (1) genus and species of plant used; (2) portions of plant used; (3) time at which plant was collected; (4) method of distillation; (5) time since distillation was made; (6) specific gravity, rotation, refraction, and dispersion; (7) solubility in various strengths of alcohol; (8) saponification and esterification numbers. A specific gravity below 0.84 indicates aliphatic compounds, above 0.9, oxygenated substances, and above 1.0, aromatic substances. Insolubility in 70 or 80 per cent. alcohol indicates hydrocarbons, in larger quantities of 90 per cent. alcohol

Digitized by Google

paraffines, sesqui- and polyterpenes. After these preliminary tests the analysis proper is undertaken, using first a small portion of the oil and then if the method employed has proved successful, the bulk of the oil, never trusting the entire stock of the oil to an untried or doubtful method of procedure. As cold does not decompose the oils, they are subjected to a chilling process, often separating crystals of menthol, borneol, etc. This can be followed by treatment with sodium bisulphite, thus separating the aldehydic and ketonic bodies, which would be destroyed by the subsequent treatment. In this process it should be borne in mind that in some cases the bisulphite compounds form very slowly, requiring several days, as in the case of thujone. Another difficulty is due to the fact that some aldehydes, like citral, unite with a second molecule of sodium bisulphite yielding liquid compounds. The aldehydic substances being removed, the acids and phenols are separated by treatment with caustic potash or soda solution, too strong solutions not being used as these dissolve hydrocarbons. Fractional distillation of the residue now follows, preferably at a reduced pressure of 15 mm.; various distilling flasks and receivers employed for this purpose are shown. The article closes with a table giving the more frequently occurring constituents of the essential oils arranged in the order of their boiling-points.

The Estimation of Bisulphide of Carbon. By A. Goldberg. *Am. Gas Light J.*, 72, 531.—The method depends upon the following reactions:

$$CS_2 + 2NH_3 = CS{<}^{SNH_4}_{NH_2}$$

$$CS{<}^{SNH_4}_{NH_2} + ZnO = ZnS + H_2O + NH_4CNS.$$

The substance under examination is heated on a water-bath in a strong, tightly-closed flask with 5 cc. ammonia (sp. gr. 0.91) and 25 cc. absolute alcohol, to a temperature of 60°, although 100° does no harm. When the reaction is finished, the solution which should be of a yellow color, is considerably diluted, a known volume of a standard ammoniacal solution of zinc is added, and the solution is heated to boiling with continuous stirring. The excess of zinc is determined by a standard solution of sodium sulphide using sodium nitroprusside as an indicator. The results of four analyses agreed well.

APPARATUS.

A. H. Gill, Reviewer.

Description of a New Respiration Calorimeter. By W. O. Atwater and E. B. Rosa. *U. S. Dept. Agr. Bull.*, 63; *Phys.*

Digitized by Google

Rev., 9, 129–163.—"The essential features of the apparatus are: 1. A chamber in which the subject of the experiment, a man, lives, eats, drinks, sleeps, and works during a period of several days and nights. 2. Arrangements for ventilation by a current of air which is drawn in from out of doors and passes through the chamber. The volume of this current is measured and the percentage of moisture in it and carbon dioxide contained in it determined before and after leaving the chamber; the temperature of the air is the same when leaving as upon entering. 3. Arrangements for passing food and drink into the chamber and removing the solid and liquid excreta. 4. Arrangements for measuring the heat given off from the body of the man in the chamber and the heat equivalent of the external muscular work." The inner chamber is provided with double walls; the innermost wall is of polished copper and measures 7x6½x4 feet inside; outside of this and separated from it by an air space of 3 inches is a zinc wall. This is surrounded with three concentric walls of wood 2 inches apart. In the spaces between these latter walls air is made to circulate by fans. To measure the temperature of the zinc and copper walls, 304 thermoelectric junctions of German silver-iron are employed. It being so arranged that no heat can escape or enter through the walls of the calorimeter, the heat generated is measured and carried away by a stream of water flowing through a copper "absorber."

A Simplified Reductor. By P. W. Shimer. *J. Am. Chem. Soc.*, 21, 723–4.—The differences from the usual form consist in the use of a small quantity of amalgamated zinc, 80 grams, supported upon a sand filter in a narrow tube. The hot lower part of the reductor is particularly effective in the reduction.

Apparatus for the Analysis of Illuminating and Fuel Gases. By G. E. Thomas. *J. Am. Chem. Soc.*, 21, 1108–1112.—The apparatus is essentially a modification of the well-known Orsat apparatus, and cannot be described without the figure. No results of work with the apparatus are given, although they are stated to be "eminently satisfactory." In view of the fact that the explosion is made over water and that the "illuminants" are absorbed with bromine, it is difficult to understand how this can be the case. Nor would this description seem to apply to the apparatus itself; for since it contains eight glass stopcocks, it must be expensive to make and maintain; and from the shape of the absorption bottles it must be fragile and cumbersome.

Note on a Method of Standardizing Weights. By T. W. Richards. *J. Am. Chem. Soc.*, 22, 144–149.—The weights are compared by substitution, the comparison beginning with centi-

Digitized by Google

grams and proceeding upwards; the weights, being the objects to be weighed, are placed on the left hand pan. Every weight is compared with every other weight of the same size and with the sum of the smaller weights; the centigram weight is assumed to be correct and from it the values of all the other weights can be determined. The data and results of standardizing a set of weights are given as an illustration.

Laboratory Method for the Continuous and Uniform Generation of Acetylene for its Purification. By J. A. Mathews. *J. Am. Chem. Soc.*, **22**, 106–108.—The fragments of calcium carbide are suspended in a basket of coarse wire netting in a wide-mouthed bottle; the bottle is closed with a doubly perforated stopper carrying a dropping tube and gas delivery tube; and the carbide is covered with 95 per cent. alcohol. The water in the alcohol starts the generation of gas which is continued by the addition of more water, the temperature being kept low by the alcohol. When the carbide is used up, the alcohol may be distilled off giving nearly absolute alcohol, especially if the first few cubic centimeters coming over be rejected. The gas is purified by passing through acid copper sulphate solution and chromic acid.

A Simplification of Beckmann's Boiling-point Apparatus. By S. L. Bigelow. *Am. Chem. J.*, **22**, 280-7.—The various asbestos stoves, mantels, lamps, etc., are replaced by a heating coil of platinum wire 20 cm. long, and 0.1 mm. in diameter. A current of two amperes gives ample heating effect for all ordinary solvents. The coil is connected up by sealing the ends through a tube afterwards filled with mercury, into which the lead wires dip. A felt mantle or preferably a Dewar's vacuum-jacketed vessel complete the apparatus. The results obtained with it by students were very satisfactory.

A Method for the Determination of the Melting-point. By M. Kuhara and M. Chikashigé. *Am. Chem. J.*, **23**, 230–233.—The modification consists in replacing the familiar capillary tube by a pair of halved microscope cover glasses held together by pieces of platinum foil and wire. This permits the heat of the bath to be conducted throughout the whole mass and enables a sharp melting-point to be taken, it being shown by the glass becoming transparent. The results obtained agree well with the usually accepted melting-points.

Absorption Apparatus for Elementary Organic Analysis. By Francis G. Benedict. *Am. Chem. J.*, **23**, 323–334.—A U-tube containing a graduated vial for the condensation and collection of water, sealed in the bend with strong sulphuric acid,

Digitized by Google

and having one arm filled with glass wool saturated with acid, is used for the absorption of water. Carbon dioxide is absorbed in slightly moistened soda-lime, two U-tubes being used, the last one being partly filled with pumice stone saturated with sulphuric acid. The increase in the second tube is usually 7 milligrams; if it be more, the first tube should be renewed. For drying the air or oxygen a 12-inch chloride of calcium jar containing pumice drenched with sulphuric acid is used; this has a tubulus sufficiently removed from the base that the cavity may contain about 20 cc. of acid.

An Apparatus for Determining Molecular Weights by the Boiling-point Method. By HERBERT N. MCCOY. *Am. Chem. J.*, 23, 353–360.—The apparatus used is a modification of Landsberger's, the change consisting in boiling a part of the solvent in a jacket outside the tube in which the substance, the molecular weight of which is to be determined, is contained. This vapor is conducted through the solution in the inner tube. By this method an equilibrium is easily maintained between vapor and solution, and condensation is avoided, so that six determinations of the boiling-point may be made with the same amount of substance where only two were formerly possible. The results agree well with those obtained by Beckmann.

A Distilling Column for Illustrating the Principle of Fractional Distillation and of Dephlegmators. By OSWALD SCHREINERS. *Pharm. Rev.*, 18, 8.—The apparatus consists of a Coffey's distilling column of twelve sections arranged for drawing off the various fractions and determining their boiling-points. Results are given showing the concentration obtained.

A Method for Carrying out Chemical Reactions under High Pressures. By B. H. HITE. *Am. Chem. J.*, 22, 80–86.—A platinum or collapsible lead or tin paint tube closed with a screw cap is placed in a lead tube 6 inches long and 1¼ inches in diameter, is filled with water, closed with a lid, and placed in a steel cylinder (6 x 7 inches) with a hole through it 1¼ inches in diameter. The lead tube rests upon a plug closing the lower end of the steel cylinder, while the upper end is closed by a piston; upon this the pressure is exerted by means of a hydraulic press, pressures up to 100 tons per square inch being employed. The effect of the arrangement is to enclose the liquids to be tested in one continuous piece of metal. Arrangements are made by means of a cylinder fitted with a screw, whereby this pressure can be maintained for a considerable length of time.

A Modified Soxhlet Apparatus for the Extraction of Fat from Liquids. By A. E. TAYLOR. *Am. J. Physiol.*, 3, 183–5.—The

Digitized by Google

modifications consist in raising the junction of the siphon tube with the body of the extractor so as to leave about 110 cc. of liquid in the latter. The solvent passes to the bottom of the extractor through a tube ending in a rose connected with the condenser, and thence up through the liquid. No cork connections are used. The apparatus is easily made and cleaned.

H. M. GOODWIN, REVIEWER.

Three Additions to the Kohlrausch-Ostwald Conductivity Method. BY J. LIVINGSTON R. MORGAN. *J. Am. Chem. Soc.*, **22**, 1–5.—The first addition consists of the substitution of a special magnetic vibrator operated at a distance for the usual vibrating spring contact in the primary circuit of the induction coil; the second, the familiar use of extension coils at the end of the slide wire bridge; and the third, the use of two contact points on the slide wire to assist in locating the position of points where the sound heard in the telephone is of equal intensity.

A New Interrupter for the Kohlrausch-Ostwald Conductivity Method. BY J. LIVINGSTON R. MORGAN. *J. Am. Chem. Soc.*, **22**, 26–28.—A slight modification of the interrupter referred to above. The wire carrying the primary current of the induction coil vibrates between the poles of an electromagnet, the contact being made and broken through a mercury cup.

Digitized by Google

Digitized by Google

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. No. 7.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

Note on the Preparation of Metallic Lithium. By LOUIS KAHLENBERG. *J. Phys. Chem.*, 3, 602–603.—Lithium may be obtained in white metallic form from solutions of lithium chloride in pyridine by electrolysis at room temperature. By electrolyzing a concentrated solution of the chloride, using a carbon plate for anode and an iron plate for cathode, a current of from 0.2 to 0.3 ampere per 100 sq. cm. of kathode area, and a difference of potential of but 14 volts between the electrodes, a dense, well-adhering, silver white coating of metallic lithium will soon be deposited.

The Supposed Isomeric Potassium Sodium Sulphites. By GEO. S. FRAPS. *Am. Chem. J.*, 23, 202–214.—According to Röhrig two isomeric sodium potassium sulphites may exist, the one being formed by neutralization of acid sodium sulphite with potassium carbonate, the other by neutralization of acid potassium sulphite with sodium carbonate. Schwicker claims to have obtained two double salts, $4C_2H_5SO_3Na+KI$, and $4C_2H_5SO_3K+NaI$, by heating the isomeric sulphites with ethyl iodide and recrystallizing from alcohol, the former by starting from acid sodium sulphite and potassium carbonate, and the latter by starting from acid potassium sulphite and sodium carbonate. This would indicate the existence of the isomeric salts $K—SO_2—ONa$ and $Na—SO_2—OK$. The work of Schwicker was repeated; the two salts which were supposed to be isomeric were heated with ethyl iodide, the time of heating and the strength of alcohol with which the product was extracted being varied. The product was analyzed for sodium and potassium. If the salts were isomeric there should be a difference in the ratio of sodium to potassium. The variation in the ratio Na : K in the different experiments is

Digitized by Google

ascribed to the difference in the conditions. The author found that recrystallization from alcohol, and the use of absolute alcohol increased the ratio, but in seven sets of experiments no values were found which would indicate the isomerism of the two salts.

Preparation and Properties of the So-Called "Nitrogen Iodide." By F. D. Chattaway and K. J. P. Orton. *Am. Chem. J.*, **23**, 363–368.—The most convenient method of preparing nitrogen iodide, $N_2H_3I_3$ is by bringing together ammonia solution and a cold solution of iodine monochloride, made by treating iodine with a mixture of hydrochloric and nitric acids to which ice has been added. The black precipitate of nitrogen iodide which at once separates may be filtered off with safety, and washed with dilute ammonia. The salt in crystalline form may be obtained by adding 15 cc. tenth-normal iodine monochloride to 100 cc. half-normal potassium hydroxide, and then adding, as rapidly as possible, 100 cc. of ammonia of sp. gr. 0.88. Glittering copper-colored crystals separate after a few moments; they are small, flattened, orthorhombic needles, dichroic, and have a specific gravity of 3.5. Pure nitrogen iodide is without action on litmus, does not give the reaction of iodine with chloroform; but in contact with water it is slowly decomposed. It may be dried in an atmosphere of ammonia over lime without decomposition, if light, to which it is extremely sensitive, be excluded. Nitrogen is slowly given off in diffused light from the compound suspended in water; in direct sunlight effervescence takes place. The partially decomposed substance is more explosive than the pure salt.

The Action of Reducing Agents upon Nitrogen Iodide. By F. D. Chattaway and H. P. Stevens. *Am. Chem. J.*, **23**, 369–376.—All ordinary reducing agents when brought in contact with nitrogen iodide suspended in water rapidly decompose it, and the quantity of reducing agent oxidized is found in every case to be exactly double the amount equivalent to the hydriodic acid produced. The reducing agents investigated were sodium sulphite, stannous chloride, hydrogen sulphide, sulphurous, arsenious, and antimonious acids. Nitrogen iodide prepared by different methods was used, and in each case the ratio of the amount of reducing agent oxidized, to that of the hydriodic acid produced was 2 : 1. The influence of the action of light upon the ratio was very marked.

On the Cause of the Evolution of Oxygen when Oxidizable Gases are Absorbed by Permanganic Acid. By H. N. Morse and H. G. Byers. *Am. Chem. J.*, **23**, 313–322.—It was suggested in a former paper (*this Rev.*, **5**, 1) that the evolution of

Digitized by Google

oxygen which occurs when hydrogen or carbon monoxide is absorbed by acidified solutions of potassium permanganate is due to the action of the peroxide which is formed upon the excess of permanganic acid; and, further that the cause of this action of the oxide upon the acid may be a tendency on the part of the simpler peroxide molecules to polymerize to more complex ones at the expense of the acid. The experiments show, as regards carbon monoxide, that when this gas is absorbed by neutral solutions of potassium permanganate there is no evolution of oxygen; but when an acid is afterwards added, there is an evolution of oxygen similar in all respects to that which is observed when an equal volume of the gas is absorbed by an acidified solution of permanganate of the same concentration. If the reduction of the acid is due to the tendency to form complex molecules, then the evolution of oxygen should gradually diminish in rapidity as the polymerization increases. This has been shown to be the case, and further it has been shown that when the gas is absorbed in acid solution the period of rapid evolution does not terminate with the disappearance of the gas, as it should if the gas is the direct cause of the liberation of oxygen. Polymerization should also require, if the quantity of the gas absorbed remains constant, that the volume of oxygen liberated within a given time increases with increasing concentration of the permanganic acid. This has also been proved to be the case. The experiments were carried out in a tube holding 100 cc. which was agitated at a nearly constant temperature.

Permanganic Acid by Electrolysis. By H. N. Morse and J. C. Olsen. *Am. Chem. J.*, **23**, 431–443.—In order to obtain manganese dioxide entirely free from potassium and other impurities the authors have devised an apparatus by which they can electrolyze potassium permanganate and obtain pure permanganic acid. The cell is composed of a beaker holding 1800 cc., placed in a galvanized iron tank through which water is kept passing. In the beaker is a porous cup of 250 cc. capacity in which is placed the negative electrode, made of a silver plate 50 mm. square, and a siphon through which the alkali may be drawn off. In the beaker the platinum positive electrode dips into a potassium permanganate solution containing about 40 grams of the salt in a liter. As a rule, the cells were found to have a low resistance in the beginning, amounting to from 5 to 10 ohms on the first day, rising to 25 or 30 ohms on the second day, and declining on the third and fourth days to 10 or 14 ohms. Different porous cells were tried, and it was found that the more porous, the smaller was the yield of acid. Using an ordinary battery cup the yield of acid has usually been from 87 to 92 per cent. of the theoretically possible amount. The concentration of

Digitized by Google

the acid was usually 9–10 per cent. Advantage was taken of the phenomenon of "electrical endosmose" for the concentration of the acid. With a current varying between 1 and 1.5 amperes, about 500 cc. of water passes out of the permanganate solution into the cup. By replacing the water thus drawn off by a 4 per cent. permanganate solution, 20 grams of the salt could be added each day. The electrical conductivity of an acid made from silver permanganate was measured and was found to agree more closely with the previous determinations of Lovén, than with those of Franke. Experiments were also made with other permanganates and with potassium dichromate which, it was found, can be electrolyzed in a similar manner.

A Contribution to the Knowledge of Tellurium. By F. D. CRANE. *Am. Chem. J.*, **23**, 408.—The author has studied the different methods of precipitation, purification, and determination of tellurium. The crude material was obtained by extracting with hydrochloric acid the residue from the electrolytic refining of copper, and precipitating by means of acid sodium sulphite. It was found that the tellurium may be precipitated by means of metallic magnesium, the excess of this metal being converted to oxide by boiling, and subsequently dissolved by acetic acid. A convenient means of removing selenium from solution was found to be by the addition of freshly precipitated tellurium which throws out of solution all of the selenium; and it is stated that it will also throw out the more metallic elements which usually accompany tellurium, but no experiments are given to confirm this statement. It was shown that tellurium may be detected in very dilute solutions by acid sodium sulphite, and that ferrous sulphate is an equally sensitive reagent for selenium (see *this Rev.*, **6**, 63) even in the presence of tellurium tetrachloride, but not in that of the dichloride. In order to avoid certain suspected sources of error, and to add nothing but hydrochloric acid as a reagent, a method of dissolving tellurium by electrolytic chlorine was devised. For the determination of tellurium a special form of apparatus was devised, whereby it might be filtered, washed, and dried in a current of hydrogen. Inasmuch as five of the six results given are high, and as tellurium has a remarkable tendency to absorb other substances when precipitated as metal—the precipitation having been made with acid sodium sulphite—the apparatus seems to the reviewer to be an unnecessary refinement. A yellow, crystalline form of tellurium dioxide was obtained by pouring a solution of tellurium tetrachloride in hydrochloric acid into boiling water.

On Chlorine Heptoxide. By ARTHUR MICHAEL AND WALLACE T. CONN. *Am. Chem. J.*, **23**, 444–446.—Perchloric acid

Digitized by Google

was prepared by bringing together 25 grams of perchlorate and 100 grams of sulphuric acid (sp. gr. 1.839 at 15°) in a fractionating flask whose low lateral tube was connected with a second flask placed in a freezing-mixture. The mixture in the fractionating flask was heated under 10–20 mm. pressure in a paraffin bath. The reaction starts at 90°, and in an hour the temperature may be raised to 160°. The yield of slightly colored acid was 85–90 per cent. In contact with paper or wood it explodes, carbonizing the material; but it may be mixed with well-cooled alcohol without explosion. To prepare chlorine heptoxide, perchloric acid was brought slowly into contact with phosphorus pentoxide in a retort cooled below —10°. The retort is allowed to stand in the freezing-mixture for a day, then connected with a well-cooled receiver, and slowly warmed in a water-bath to 85°, when the oxide passes over. The freshly prepared substance may be redistilled under ordinary pressure. Chlorine heptoxide is a colorless, very volatile oil, which on standing turns yellowish green with liberation of a greenish gas. Brought into contact with a flame it explodes violently, but in contact with most substances it is remarkably stable. It may be poured on wood, paper, or similar organic substances with impunity. No reaction takes place with stick sulphur even after standing several days. It may likewise be poured on a cooled piece of phosphorus and remain several days without being attacked. A slow reaction takes place when it is brought into contact with benzene or iodine. With cold water it sinks to the bottom of the vessel, and slowly passes over into perchloric acid.

Some New Tellurium Compounds. By Victor Lenher. *J. Am. Chem. Soc.*, **22**, 136–141.—The chlortellurates and the bromtellurates of methyl, and ethylamine, aniline, pyridine, and quinoline, and the bromtellurate of trimethylamine were prepared by bringing together solutions of their salts in the corresponding halogen acids. The precipitate thus formed was purified by recrystallization from an acid solution. Since the author has not mentioned the preparations in which the salts were brought together, we are led to infer that only the 2 : 1 type of salt is capable of existence, but it seems more than probable that others of not so simple a type could have been isolated if the proportions of the two salts had been varied.

The Thermochemistry of Iron and Steel. By E. D. Campbell. *J. Am. Chem. Soc.*, **22**, 205–206.—This paper is a withdrawal of a former article entitled "A Preliminary Thermochemical Study of Iron and Steel" (*this Rev.*, **3**, 2). It is now shown that the solution of carbide of iron in double chloride of copper and ammonium is much accelerated when a small quantity of

Digitized by Google

free hydrochloric acid is present, but that the amount of free acid up to 4 per cent. does not appreciably influence the amount of heat evolved. The heat of solution of steel in slightly acid copper ammonium chloride is not changed more than 2 per cent. by variation in the heat or mechanical treatment of the sample.

Notes on Selenium and Tellurium. By EDWARD KELLER. *J. Am. Chem. Soc.*, 22, 241–245.—In a previous paper (*this Rev.*, 4, 4) the author pointed out the difference of behavior of selenium and tellurium in the dioxide state, towards sulphur dioxide and ferrous sulphate in solutions of hydrochloric acid. These reactions have now been studied with the idea of using them for the quantitative separation of the two elements. It has been found that selenium is most readily precipitated by sulphur dioxide in strong hydrochloric acid solution while tellurium is not precipitated until the acidity of the solution is lowered to 80 per cent. Details are given for the application of this method to the quantitative determination of selenium and tellurium in copper. The author has found that in commercial work the criticism against determining tellurium in the metallic state on account of oxidation is unjustified.

Upon Bismuth Cobalticyanide. By J. A. MATHEWS. *J. Am. Chem. Soc.*, 22, 274–277.—The quantitative precipitation of bismuth cobalticyanide was studied. The precipitate is crystalline, settles and filters well, and retains water below 165°. The author remarks that it has not been found useful in the analysis of pig-lead, as anticipated, "but it may still be found useful in the analysis of lead-bismuth alloys, 'fusible metals' such as Wood's alloy, etc." His results do not, however, in the least indicate its usefulness. Below a concentration of 0.0079 gram of bismuth per cubic centimeter the precipitation was under no conditions complete, and at ten times that dilution no precipitate was produced even on long standing.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Zellweger Roasting Kiln. By J. ZELLWEGER. *Eng. Min. J.*, 69, 260–262.—This is a straight-line, single-hearth, mechanical reverberatory roasting furnace, 15 × 135 feet, with external fire places. The new feature is the rolling stirrer which turns over the ore and moves it slowly from feed to discharge. It consists of a heavy shaft carried by wheels, 6 feet in diameter, rolling on tracks in the depressed wheel-pits on either side of the hearth. The shaft carries a number of collars on which are mounted projecting V-shaped blades. While travelling from feed to dis-

Digitized by Google

charge, the collars are locked to the shaft, and the blades scoop up the ore during one-half of a revolution and discharge it during the other half, thus stirring, mixing, and moving it. During the return trip, the collars are unlocked, and revolving around the shaft cause the blades to displace the ore only about in the same way that a plow or rake would. The furnace is in use at the works of the Cherokee Lanyon Spelter Co., Gas City (Iola), Kans., and treats in twenty-four hours 15 tons of blende reducing the sulphur to 1 per cent., 12½ tons if the sulphur is reduced to ½ and 16½ tons if 1½ per cent. sulphur are allowed to remain in the roasted ore.

Utilizing the Heat of Molten Slag. By H. Lang. *Eng. Min. J.*, **69**, 493–494. By Bretherton, *Eng. Min. J.*, **69**, 614.—The author criticizes the claims made by Bretherton (*this Rev.*, **6**, 45) that by means of his apparatus he is able to raise the temperature of the blast to 500°–600° F. The second reference is to Bretherton's reply.

Notes on Lead Smelting and Gold and Silver Refining; V, Cost of Smelting Silver-Lead Ores. By M. W. Iles. *Eng. Min. J.*, **69**, 258–259.—After a few general remarks on the relations that should exist among the officers in charge of a smelting plant, the author shows that between 1887 and 1898 the cost of smelting at the works of the Globe Smelting and Refining Co., Denver, Colo., was reduced from $4.644 to $2.260 per net ton of ore. In 1886, the blast-furnaces were 36 × 100 in. at the tuyeres, 11 ft. from tuyeres to throat, the blast pressure was 1 lb. per sq. in., the matte settlers had a capacity of 6 cu. ft. and slag was collected in pots holding 250 lbs. which were pulled by men. In 1899, the blast-furnaces were 42 × 120 in. at tuyeres, 16 ft. from tuyeres to throat, the blast pressure was 3–4 lbs. per sq. in., the matte boxes (at the Globe works) had a capacity of 128 cu. ft., and small switch-engines handled per trip 3000–6000 lbs. slag. The results were obtained with slags containing 31–34 per cent. SiO_2. When a slag ran high in lead, this could be reduced by adding lime to the charge or in some cases by increasing the percentage of fuel. While iron flux was more expensive than limestone, it was often advantageous to make slags running high in iron on account of the larger amount of charge that could be put through with them. The author is confident that the cost of $2.26 for smelting a net ton of ore can be further reduced by using coke made from washed coal (the present Colorado coke containing 16½–22 per cent. ash), and by improving the system of handling.

Digitized by Google

Notes on Lead Smelting and Gold and Silver Refining,—Apparatus for Collecting Solids from Smoke. By M. W. Iles. *Eng. Min. J.*, 69, 647.—The paper is an illustrated description of a No. 2 Pelton wheel driving a Monogram Sturtevant blower which aspirates the smoke and delivers it into a tin box, 3 ft. square and 5 ft. high, with a discharging door at the side and thimble, 18 in. in diameter and 12 in. long, at the top. Over the thimble is placed a sack, 60 in. in circumference and 20 ft. long, made of plain woven cotton cloth having, per square inch of surface, 44–50 threads in the warp and in the woof. By running the apparatus for 10–14 days and gathering the filtered solids, a correct idea of the metal lost is easily obtained.

A Portable Stamp-Mill. By Taylor. *Eng. Min. J.*, 69, 263.—The apparatus which serves to make working tests on small batches of gold ore, consists of two parts. The lower one is a cast-iron mortar (8 in. in diameter) with a square discharge (6 × 6 in.); the upper one, fastened to the mortar with a hinge-pin and hinge-bolt, is a cast-iron conical cover carrying two columns for the cam-shaft. The single stamp, weighing 45 lbs., is operated by hand and drops 6½–7 in. with a force of 750 lbs.; the ore is fed through an opening in the cover.

Water and Fuel Economy in Stamp Milling. By A. W. Warwick. *Eng. Min. J.*, 69, 529–530.—Engineers frequently assume that a ten-stamp gold mill requires about 800 gals. water per hour when the water is allowed to run off with the tailings. As to fuel and water consumption, using a locomotive boiler and an engine with a throttle governor, a fair figure is 8½ lbs. coal and 7½ gals. water per horse-power hour. The following data obtained by the author at the mill of the Matterhorn mine, in the southeast corner of the Mojave desert, show that an effective system of water saving will reduce the 800 gals., usually required per hour by a ten stamp mill, to 200 gals., or 75 per cent.

Week.	Water supplied in gals.	Hours run.	Water per stamp per hour. Using once.	Actually used.	Per cent. recovered.
1	13154	82	80	16.0	80.0
2	16760	80	95	22.2	76.8
3	15487	81	93	19.1	79.4
4	14850	80	92	18.5	79.8

On account of the large amount of water required for making steam, the author advocates the use of an oil-engine. At the Matterhorn mill a Fairbanks-Morse engine of 34 brake horse-power, with cooling water used continuously, required in twelve hours only 55 gals. water to make up the loss by evaporation.

Digitized by Google

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. No. 8.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Montana and Denver Reduction Company's Mill at Bearmouth, Mont. BY F. D. SMITH. *Eng. Min. J.*, 69, 348–350.—The paper is an illustrated description of the mill which aims to do custom work on gold ores. It contains 5 ore-receiving bins of 20 tons' capacity, a Blake crusher 9 × 15 in., an elevator, a pair of rolls, a Vezin mechanical sampler, 4 storage bins with a capacity of 25 tons sowing 4 five-stamp batteries, a hydraulic seizer, 4 double-deck Wilfley tables, 4 cyanide tanks of 100 tons' capacity with the necessary zinc boxes, storage tanks, etc. The mill has a capacity of 60 tons in 24 hours, and is driven by an 80 horse-power engine, steam being furnished by two 50 horse-power boilers.

Hydraulic Amalgam Squeezer. BY FRAZER AND CHALMERS. *Eng. Min. J.*, 69, 499.—This apparatus, in use at the Treadwell mill, Douglas Island, Alaska, serves to free the gold amalgam collected from the mortar, plate, etc., more effectively from the surplus quicksilver than is possible when done by hand.

A Clean-up Trolley for Gold Mills. BY FRAZER AND CHALMERS. *Eng. Min. J.*, 69, 436.—This device consists of a trolley with cages and bucket. It is used for handling amalgam, shoes, dies, etc., during a clean-up, and thus facilitates the work and permits the collecting and cleaning of the amalgam to be done in one room under proper supervision.

Oxygen in the Cyanide Process. BY W. JONES. *Eng. Min. J.*, 69, 404.—The author emphasizes the necessity of supplying cyanide solutions with air, if they are to extract gold from slimes that have been stored for some time and thus have become contaminated with organic matter.

Digitized by Google

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

Physical Reactions and the Mass Law. BY AZARIAH T. LINCOLN. *J. Phys. Chem.*, 4, 161–187.—A large part of the article is devoted to a summary of the previously published considerations of Bancroft (*Phys. Rev.*, 3, 21), who assumed that certain cases of heterogeneous physical equilibrium can be expressed by exponential formulas somewhat analogous to those which the Mass Action Law requires in the case of homogeneous chemical equilibrium. Thus, the quantities x and y of two non-miscible liquids which are present in a homogeneous mixture of them with a definite constant quantity of a third liquid miscible with both, at the point when separation into two layers just begins to take place, are assumed to be related to each other, in the way expressed by the equation $x^n y = C$, where n and C are arbitrary constants which may have any positive value whatever. In order to confirm the idea that this formula is not merely an empirical one, but is the expression of a "newly discovered Law of Nature," the author shows by experiments more accurate than those previously published that the formula does express, in most cases with a difference of less than one-third of a per cent. between the found and calculated values of one of the components, the condition of equilibrium between benzene, water, and ethyl alcohol at the point of saturation. The reviewer must, therefore, again call attention to the fact (see *Tech. Quart.*, 8, 306) that any two-phase heterogeneous equilibrium is determined by the composition of *both* phases, and that if the composition of both of them is variable, as is the case in the example above cited, a formula like that proposed which takes into account the composition of only one of them *can* have only an empirical significance.

On the System Water, Phenol, and Hydrochloric Acid. BY W. H. KRUG AND FRANK K. CAMERON. *J. Phys. Chem.*, 4, 188–192. The authors have determined the temperature at which solid phenol separates from the liquefied phenol layer formed when solid phenol is placed in contact with water and aqueous solutions of hydrochloric acid of various concentration. The freezing-point of the phenol was 1.365° with the pure water, and 17.195° with the most concentrated hydrochloric acid used, which contained 131.3 grams per liter. The results have no quantitative significance from a theoretical standpoint, for the authors have chosen for their investigation a phenomenon which is the resultant of two independent effects—first the reduction of solubility of the water in the phenol by the hydrochloric acid dissolved in the water,

Digitized by Google

and second, the lowering in melting-point of the phenol by the water dissolved in it.

On Two Theorems of Gibbs. By PAUL SAUREL. *J. Phys. Chem.*, 4, 193–199.—The author shows that Gibbs' equation expressing the relation between changes of pressure and temperature in a univariant system is equivalent to the Clapeyron-Clausius formula, whatever may be the number of components; and that Gibbs' equation for bivariant systems can, when certain conditions are satisfied, likewise be brought into the same form.

The Relation of the Taste of Acids to Their Degree of Dissociation. II. By THEODORE WILLIAM RICHARDS. *J. Phys. Chem.*, 4, 207–211.—The author shows that the facts previously noted by several investigators that weak acids and acid salts have, in comparison with hydrochloric acid, a much sourer taste than is consistent with the assumption of proportionality between sourness and concentration of the hydrogen ions, is readily explained in accordance with the dissociation theory, contrary to the belief of Kahlenberg (*this Rev.*, 6, 73), if it be assumed that the actof tasting removes hydrogen ions and that these are replaced by the production of new ones, at the expense of the undissociated acid or acid salt. This same explanation has been independently suggested by the reviewer (*this Rev.*, 6, 73).

Isohydric Solutions. By WILDER D. BANCROFT. *J. Phys. Chem.*, 4, 274–289.—It is shown that the Mass Action Law requires that there be a displacement of the equilibrium of any reaction: $aA + bB + \cdots + mM = a_1A_1 + b_1B_1 + \cdots + m_1M_1$ by the addition to the mixture of any volume of one of the substances, such as A_1, even if the concentration of the latter in the volume added is equal to that of it in the original mixture, *except* in the case where $a + b + \cdots + m = b_1 + \cdots + m_1$. If the right-hand member of this expression is *greater* than the left-hand member, the right-hand system will increase in concentration; if *less*, it will decrease. The author applies the principle theoretically to a number of special cases of gaseous and electrolytic dissociation. Gaseous ammonium carbamate may be here cited as an example: in this case $a + b + \cdots + m = 1$ and $b_1 + \cdots + m_1 = 1$ if ammonia is added to the equilibrium mixture, and $b_1 + \cdots + m_1 = 2$ if carbon dioxide is added; consequently there will be no change in the equilibrium in the former case, and an increase in the dissociation (or amount of carbamate volatilized) in the latter. This principle is especially applied to the dissociation of diionic salts, which, as previously pointed out by Storch, are not subject to the simple laws of isohydric solutions by reason of the fact that the exponents occurring in the expression of the empirical dilution law are appar-

Digitized by Google

ently, at least, not identical with those required by the Mass-Action Law. The author calculates from the empirically determined exponents that on mixing hundredth-normal solutions of potassium and sodium chlorides the dissociation, and therefore the conductivity, of each salt should be reduced over one per cent. An experiment made by A. T. Lincoln showed that, instead of the theoretical decrease, an increase of 0.8 per cent. occurs.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

The Technical Estimation of Zinc. BY ALBERT H. LOW. *J. Am. Chem. Soc.*, **22**, 198–202.—The ore is treated with nitric acid, first with the addition of potassium nitrate, later with that of a cold saturated solution of potassium chlorate in nitric acid, and the whole is evaporated to dryness. The residue is treated with an ammoniacal solution of ammonium chloride, the filtered solution made acid with hydrochloric acid, and, after the removal of the copper and cadmium by sulphuretted hydrogen, the zinc is titrated for by means of potassium ferrocyanide solutions, using uranium nitrate as an indicator. When cadmium is absent, the copper may be thrown out by means of test lead.

The Repeated Use of the Double Chloride of Copper and Potassium for the Solution of Steel or Iron in Estimating Carbon. BY GEO. WM. SARGENT. *J. Am. Chem. Soc.*, **22**, 210–213.—The author finds that if chlorine is passed into the double chloride solution after it has been used to dissolve iron, it regains its color and is more energetic in its solvent action than when freshly prepared. As many as eleven portions of drillings have been treated successfully with the same solution, by regenerating it each time after use. Oxidation by means of an air current, or by electrolytic methods, was less successful than that brought about by passing chlorine gas into the solution.

Notes on Selenium and Tellurium. BY EDWARD KELLER. *J. Am. Chem. Soc.*, **22**, 241–245.—A method for the quantitative separation of selenium and tellurium is based on the fact that sulphur dioxide will throw down selenium alone from cold solutions of the two elements containing about 80 per cent. by volume of concentrated hydrochloric acid, or one hundred times as much acid as tellurium.

Digitized by Google

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. No. 9.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

INDUSTRIAL CHEMISTRY.

F. H. THORP, REVIEWER.

The Fertilizer Resources and the Fertilizer Industry of Alabama. BY B. B. ROSS. *Proc. Ala. Industrial and Sci. Soc.*, 9, 51–58.—The article is mainly a historical sketch of the development of the fertilizer industry in the southern states, the present status of the manufacture in Alabama being well set forth. It appears that the raw materials, excepting cotton-seed meal, are mainly imported from the neighboring states, although phosphate rock of some value has been found in Limestone Co. The author's analyses of this rock are quoted as showing from 9 to 25.1 per cent. phosphoric acid. An acid phosphate made from this rock showed 14.90 per cent. total phosphoric acid, of which 13.15 per cent. was water-soluble. Valuable deposits of green sand marl are found in the state, the analyses given showing them to contain 2.24–2.74 per cent. phosphoric acid and 3.78–3.86 per cent. potash. Other materials found in the state are mucks, which are highly recommended for building up the soil. An analysis of bat manure from the Tennessee Valley demonstrated its fertilizer value to be above $30 per ton, based on the scale of fertilizer values in the state. The paper closes with a discussion of the abstraction of nitrogen from the air by certain leguminous plants, such as the cow-pea, clover, and vetch, when grown upon land containing certain bacteria, which thus become valuable fertilizers when plowed under; and with a discussion of the advantages gained by inoculations of the soil with these bacteria from cultures.

Commercial Fertilizers. *Vt. Agr. Expt. Sta., Bull.* 79, 189–198; 80, 201–244.

Digitized by Google

The Effect of Salt Water on Cement. By A. S. Cooper. *J. Franklin Inst.*, 148, 291–302.—Mortars containing various proportions of cement and sand were prepared with fresh water and with salt water. Briquettes made from each mixture were allowed to set for 24 hours in moist air, and then some from each mixture were put into salt water and fresh water to harden. Compression and tension tests were made on these after seven days and twenty-eight days, and at the end of six months and one year. The salt water briquettes showed better results in the earlier tests, but after longer periods the fresh water briquettes showed greater strength. It was also indicated that salt water tends to weaken concrete, but no definite opinion could be stated. It also appeared that rough, sharp sand, made by crushing hard rock, produced briquettes of greater strength, though much depends on the thoroughness of the ramming. It is also shown that mortar made with Portland cement suffers very little injury, even after several hours' standing, if it is kept thoroughly wet.

Manufacture of Alcohol from Acetylene. *U. S. Consular Rep.*, 62, 287–293.—The article consists of four reports by the Consuls at Paris, Berne, Berlin, and Frankfort, setting forth the present status of the industry. Letters from the leading authorities, Berthelot, Maercker, Rossel, and Liebetang, regarding the future prospects of the industry, are included. Descriptions of the manufacture are also given. The concensus of opinion appears to be that the fermentation-alcohol industry need not anticipate any competition from this direction. The cost of calcium carbide and the small yield of alcohol make the acetylene product about ten times as expensive as ordinary alcohol.

A New Electrolytic Process of Manufacturing Chemicals. By James Boyle. *U. S. Consular Rep.*, 62, 189–191.—A short, popular review of the Hargreaves-Bird process, stating its economies and advantages, forms the substance of the report.

What is Parianite? By S. F. Peckham. *J. Franklin Inst.*, 149, 161–193.—The author's conclusion is that at present we know very little concerning the composition of parianite; but he contends that the course of investigation already entered upon "will ultimately lead to conclusions that will be final." A description of the specimens is first abstracted from a previous paper (*Am. J. Sci.*, 1896); then the method of analysis is discussed. Considering parianite as an emulsion of gas, mineral water, bitumen, organic matter not bitumen, and mineral matter such as silica and clay; or as an emulsion of gas, water holding mineral salts, bitumen, and organic salts of iron, alumina, lime, and magnesia with ulmic and other peat acids, with ferrous sul-

Digitized by Google

phide and silica, the author holds that it cannot be determined of what the mixture consists by "any process that separates a hypothetical substance called petrolene and a second called asphaltene, a third called organic-matter-not-bitumen, and a fourth called mineral matter." There is also considerable discussion of the work of C. Richardson (see *J. Soc. Chem. Ind.*, *1897* and *1898*) and numerous analyses by Miss L. Linton are given. An extended discussion of the paper follows in which Messrs. Endemann, Sadtler, Day, Keller, and Allen (Sheffield, England), and Prof. Peckham take part. Dr. Endemann concludes from his investigations that some asphalt contains a hydrocarbon, $C_{26}H_{28}$; and that hard asphalts contain an oxygen compound to which he assigns the formula $C_{26}H_{36}O_3$, or with new asphalts, $C_{20}H_{24}O_2$. He thinks the ulmic acid of Peckham comes from the turpentine used in the extraction rather than from the asphalt. He considers asphalt as an oxidation-product of petroleum; and he found, by heating a petroleum oil with potassium bichromate, sulphuric acid, and water, for two to four months on a water-bath, that the oil thickens and takes on the odor of asphalt.

Recent Progress in the Aluminium Industry. By Jos. W. Richards. *J. Franklin Inst.*, **149**, 451–459.—Reduction processes are still the same in principle as the Hall process of ten years ago. The cost of materials and working has been materially reduced. The cost of aluminum is now about two-thirds that of brass. Aluminum is now worked into light and strong alloys; five per cent. of copper, nickel, or manganese, or thirty per cent. of zinc make strong metals with aluminum. The use of the metal for culinary utensils, for novelty goods and bric-a-brac, for lithographic plates, and electric conductors has reached large proportions; over 500 tons were used last year for transmission lines and feed wires, replacing copper. Powdered aluminum is used for silvery printing and paint, as on the U. S. mail boxes; also for the reduction of refractory metallic oxides, such as those of manganese, chromium, tungsten, molybdenum, vanadium, uranium, and boron. Many of these, alloyed with iron, are used in making steel at Krupp's works.

Railway Bearings: An Investigation of Causes of Hot Boxes in Railway Service, and Methods for Their Prevention. By Robert Job. *J. Franklin Inst.*, **149**, 439–450.—Bearings which had run hot on cars from different railroads while passing over the Philadelphia and Reading R. R., were examined metallographically and chemically, Test sections were cut, and the tensile strength and elongation determined. Along with these tests a number of alloys were made, to check the accuracy of the

Digitized by Google

deductions and to determine the best conditions of foundry practice. In composition wide variations were found. Some consisted of copper-tin in the ratio of 7 : 11. Others were of copper-zinc, with as high as 35 per cent. of zinc; these seldom caused heating, but were subject to rapid wear. Phosphor bronzes were found in moderate numbers; but the copper-tin-lead alloys, averaging 10–15 per cent. of tin with from 15–5 per cent. of lead, were most common. In most cases it appeared that the composition caused but little of the difficulty, the chief causes of the heating effects being: segregation of the metals; coarse crystalline structure; dross or oxidation-products; and excessive amount of gas enclosed in the metal. Deficient lubrication appeared to have caused but little of the trouble. Segregation, caused by attempts to alloy the metals in improper proportions, especially in the copper-tin-lead compositions, where the liquation of the excess of lead or the separation of copper resulted, caused surfaces of high heating capacity. Photomicrographs are shown of a number of compositions. The composition of one which had heated in service was: copper, 74.67; tin, 15.27; lead, 10.27 per cent. Segregation is best prevented by slow pouring and rapid cooling in the mold. Crystalline structure was found to be due to antimony in some cases, but often was caused by rapid pouring at too high temperature, or by the use of an excess of deoxidizing agents. It increased local friction, decreased the tensile strength, and caused excessive wear. Particles of dross held mechanically caused friction and heating. Occluded gas tended to reduce the bearing surface of the metal, thus increasing the pressure and causing rapid wear. Deoxidizing agents, especially phosphorus, remove the occluded gases. Zinc in proportion of 1 or 2 per cent. has been shown by Dr. Dudley to act as a deoxidizer, but more than this weakens the metal. Sodium acts similarly. The author approves of the addition of silicon in small proportion with the zinc, to obtain a fine-grained ductile metal. Arsenic has been used as deoxidizer, but it has no advantage. Tensile strength and elongation limits in bearing metals are essential, as experiments demonstrated that increase of strength and ductility means increased life to the bearings in service. The etchings for microscopic examination were made on the polished metal, commonly by the use of decinormal solution of iodine in potassium iodide; but in a few cases, dilute chromic or nitric acid was used.

New Method of Bleaching in Germany. *U. S. Consular Rep.*, **63**, 253.—A short account of Koechlin's process of bleaching vegetable fibers by the use of bisulphite of sodium, or lime, or the "hydrosulphite" of calcium. The goods are then steamed under one to two atmospheres' pressure. In another pro-

Digitized by Google

cess the goods are exposed for six hours to the action of alkali, soap, calcined magnesia, and hydrogen peroxide. These bleaches are claimed to do no injury to the fibers.

Sod Oil, Wool Grease, and Degras. By ERASTUS HOPKINS. *J. Am. Chem. Soc.*, **22**, 351–353.—By a confusion of names in paragraph No. 279 of the tariff act of 1897, a question as to the identity of wool grease and sod oil arose, and an investigation of the nature of these substances was undertaken. It was shown that sod oil and wool grease have different constitutions and characteristics. Wool grease is extracted from sheep's wool; sod oil is an oxidized oil expressed from leather which has been curried with fish oils. Sod oil contains a substance designated as "degras former," which is stated to be characteristic of this oil; it is not present in wool grease, nor in other oils. Degras is a trade name including both substances.

A. H. GILL, REVIEWER.

Texas Petroleum. By F. C. THIELE. *Am. Chem. J.*, **22**, 489–493.—The Corsicana oil resembles the Lima oil, but does not have the disagreeable odor of the latter; it has a specific gravity of 0.829, and seems to be closely related to the Pennsylvania oil of the Washington district; it contains a certain proportion of substances closely resembling asphaltum, as is shown by its giving a precipitate with $SnCl_4$. The oil from the Nacogdoches district is black and very heavy, and strongly impregnated with sulphuretted hydrogen, resembling a maltha. Its specific gravity is 0.915. Saratoga oil has a gravity of 0.955, and that of Sour Lake a gravity of 0.963, the heaviest oil in this hemisphere. It leaves a residue of 71 per cent. above 641° F., and contains no paraffin, but 20 per cent. asphaltum. It is composed of hydrocarbons excellently well adapted for lubricating purposes. A pitchy mass was obtained from the oil, which resembled that obtained from the distillation of stearin, a fact which may substantiate the theory of Höfer and Engler regarding the origin of petroleum.

BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

On the Elimination of Nitrogen, Sulphates, and Phosphates after the Ingestion of Proteid Food. By H. C. SHERMAN AND P. B. HAWK. *Am. J. Physiol.*, **4**, 25–49.—Experiments conducted upon healthy human subjects under normal conditions of nutrition show that the rates of excretion of nitrogen and sulphates are quite similar, the minimum being reached during the

Digitized by Google

night; the rate of excretion of phosphates, however, is essentially different from either and reaches a minimum after breakfast. When lean beef, sufficient to furnish about 63.7 grams of extra protein, was taken, the nitrogen excretion began to rise in the first three hours and reached a maximum between the sixth and ninth hours, again reaching the normal after about thirty-six to thirty-nine hours. The increased excretion of sulphates followed the same general course. The increased rate of excretion of the phosphates reached a maximum at the same time as that of the nitrogen, but regained the normal after about twelve to fifteen hours. The increased heat of combustion of the urine was but little greater than would correspond to an amount of urea equivalent to the extra nitrogen eliminated.

The Gluten Constituents of Wheat and Flour and Their Relation to Bread-making Qualities. By H. A. Guess. *J. Am. Chem. Soc.*, **22**, 263–268.—The author has tabulated the results of analysis of a number of samples of Canadian wheat, giving the locality, the buyer's grading mark, the percentages of gliadin and glutenin, the ratio of the two, and a "composite factor" representing the product of this ratio by the total percentage of gluten. This composite factor is considered to be more truly a measure of gluten value, since it represents the total number of units of gluten present multiplied by the value per unit.

The Digestibility of American Feeding-stuffs. By Whitman H. Jordan and Frank H. Hall. *U. S. Dept. Agr., Expt. Sta. Bull.*, 77, 1–100.—This bulletin contains a compilation of the experiments made at experiment stations in the United States on the digestibility of feeding-stuffs by farm animals. A résumé of the data practically complete to 1899 is given, coefficients of digestibility for all important American feeding-stuffs being thus available.

Analyses of Strawberries. By G. W. Shaw. *Ore. Agr. Expt. Sta. Bull.*, **62**, 6–9.

A Normal Chlorine Map of Long Island. By George C. Whipple and Daniel D. Jackson. *Tech. Quart.*, 13, 145–148.—The map constructed from the results of analyses of eighty samples of water, apparently normal, shows that, except at the eastern end of the island, the normal chlorine is below six parts per million. At the eastern end the chlorine is very high and varies greatly in different localities, resembling the chlorine of Cap Cod, in Massachusetts, in this respect.

Digitized by Google

ANALYTICAL CHEMISTRY.

PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

Soil Humus: Some Sources of Error in Analytical Methods. BY A. L. EMERY. *J. Am. Chem. Soc.*, **22**, 285–291.—The author points out three sources of error in ordinary methods of soil analysis: (1) In washing samples free from calcium salts with dilute hydrochloric acid, some of the organic matter is liable to be dissolved. (2) When the soil is leached with caustic potash, part of the nitrogen is expelled as ammonia, the amount depending upon the nature of the soil and the time of leaching. (3) When the soil is leached with ammonia water, ammonia is taken from the solution and held in combination with the organic matter. Since nitrogen in the humus is determined by dividing the nitrogen in the potash extract, which is too low, by the humus, which is too high, the error is multiplied, and the result is almost invariably too low.

An Examination of Brown and Taylor's Official Method of Identifying Butter. BY JOHN A. HUMMEL. *J. Am. Chem. Soc.*, **22**, 327–329.—The increasing production of "renovated" butter makes it important to have some ready method for its identification. In chemical properties and composition the differences between renovated and normal butter are too slight to be of use, but the difference in behavior towards polarized light is sufficient in many cases to indicate the character of the sample. This difference is shown by photomicrographs of representative preparations.

On the Relation of the Reducing Power of Normal Urine to the Amount of Certain Nitrogen Compounds Present. BY J. H. LONG. *J. Am. Chem. Soc.*, **22**, 309–327.—The author has determined directly the reducing power of uric acid and creatinin in terms of cupric oxide, using a modified form of Pavy's solution. The total reducing power of the urine and also the amounts of nitrogenous substances present was likewise determined. It was found that on the average 46.6 per cent. of the total reducing power was due to sugar, corresponding to 1.514 grams per liter, or about 0.15 per cent.

On Acetic Acid as a Substitute for Ethyl Alcohol in Extracting the Active Principles of Some Officinal Drugs. BY EDWARD R. SQUIBB. *Am. J. Pharm.*, **72**, 311–319.—In this paper, the fourth on the subject, the author gives the results obtained on buckthorn and cascara sagrada.

Digitized by Google

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

On the Determination of Carbon and Hydrogen by Combustion in Oxygen, Using Copper Oxide. BY CHARLES F. MABERY AND WILLIAM R. CLYMER. *J. Am. Chem. Soc.*, **22**, 213–218.—To purify the oxygen and air used during combustions, two pieces of combustion tubing 1.75 meters long and bent at the ends are filled with broken glass moistened with concentrated sulphuric acid in one case and 40 per cent caustic potash solution in the other. These may be fastened to the wall. Sulphuric acid is found to be the best absorbent for water, and if not more than 2–3 cc. are used to collect the water, no carbon dioxide is retained under the conditions of an ordinary combustion. The gas flow may reach 1000 cc. per hour without loss. A rate of 500 cc. per minute through the potash bulbs does not cause loss of moisture, when the calcium chloride is freshly fused and finely granular. In the combustion of hydrocarbons the tube should be first filled with oxygen before volatilization commences. As high a heat as can be used without danger to the life of the combustion tube, is desirable.

Note: Test for Tin. BY ALLEN ROGERS. *J. Am. Chem. Soc.*, **22**, 220.—The addition of a stannous chloride solution to one of ammonium molybdate, as usually prepared, gives a blue tint to the mixture, even in the presence of only 0.0000042 gram of stannous chloride per cubic centimeter.

The Estimation of Alumina and Ferric Oxide in Natural Phosphates. BY F. P. VEITCH. *J. Am. Chem. Soc.*, **22**, 246–258.—Ammonium phosphate is added to the solution of the aluminum, then ammonia to alkaline reaction, the resulting precipitate is redissolved in hydrochloric acid, and the number of cc. required to accomplish this, after the solution has become acid, is noted. The solution is diluted to 250 cc., and for each cc. of acid added 5 cc. of a 50 per cent. ammonium thiosulphate solution is now dropped in slowly. On boiling for half an hour the aluminum is precipitated, and the precipitate is washed, dried, ignited, and weighed as $AlPO_4$. Two precipitations are necessary in the presence of large quantities of iron or lime. Magnesium, sodium, and potassium salts are without effect; silica and fluorine must be previously removed; the sulphates present must not exceed the equivalent of 1.25 grams of sulphuric acid.

The Distillation of Ammonia in the Determination of Nitrogen. BY FRANCIS GANO BENEDICT. *J. Am. Chem. Soc.*, **22**, 259–263.—To hasten the complete transference of the liberated

Digitized by Google

ammonia to the receiving flask, a device is used by which the condenser water is run off after a definite time, allowing the whole delivery-pipe to be heated for a few moments by the steam. In this way the time of distillation is shortened, without danger of loss of acid from the solution in the receiving flask.

Lime and Sulphuric Acid by the Photometric Method. By J. I. D. HINDS. *J. Am. Chem. Soc.*, 2,2 269–274.—This paper is supplementary to an earlier one on the same subject (*J. Am. Chem. Soc.*, 18, 661). A table is appended to facilitate the calculation of percentages.

A Rapid Method for the Determination of Carbon in Iron or Steel by Combustion. By GEO. WM. SARGENT. *J. Am. Chem. Soc.*, 22, 277–285.—An apparatus is described in detail with which a combustion may be completed in twenty minutes. The author points out that a stream of electric sparks may replace the copper oxide, although, on account of the wear upon the terminals of the induction coil as a result of constant use, the employment of the oxide is still advised.

On the Preparation of Potassium Xanthate for Nickel Determinations. By E. D. CAMPBELL. *J. Am. Chem. Soc.*, 22, 307–308.—Commercial xanthate does not give satisfactory results when used in the author's method for the determination of nickel (*J. Am. Chem. Soc.*, 17, 125). A procedure is described for the preparation of a pure, stable salt from absolute alcohol, carbon disulphide, and potassium hydroxide.

Remarks on some Methods of Determining Carbon in Steel. By GEORGE AUCHY. *J. Am. Chem. Soc.*, 22, 334–343.—The methods commented upon are: The loss on ignition of carbon sponge; the combustion methods, wet and dry; and the color method. Suggestions are made as to possible sources of error in each procedure.

A Method for the Determination of Zinc by the Use of Standard Thiosulphate Solution. By RICHARD K. MEADE. *J. Am. Chem. Soc.*, 22, 353–356.—The procedure is analogous to that proposed by the author for the determination of magnesium (see *this Rev.*, 5, 100). The zinc is precipitated as zinc ammonium arsenate in a slightly acid solution, and the precipitate is dissolved in hydrochloric acid. Potassium iodide is added to the solution and the liberated iodine measured by means of a thiosulphate solution. Calcium and magnesium are first removed by precipitation with arsenate in an alkaline solution. Manganese must be removed as dioxide by potassium chlorate.

Digitized by Google

Digitized by Google

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. No. 10.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F H. Thorp.

ORGANIC CHEMISTRY.

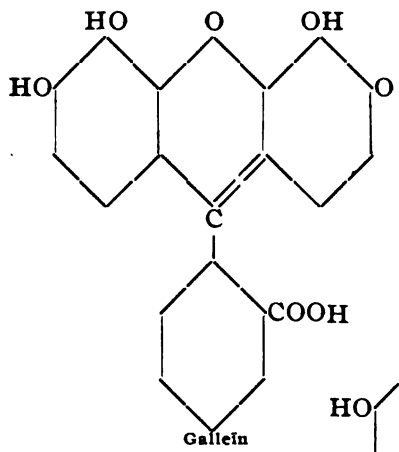
J. F. NORRIS, REVIEWER.

On Certain Colored Substances Derived from Nitro Compounds. BY C. LORING JACKSON AND F. H. GAZZOLO. *Am. Chem. J.*, 23, 376–396; *Proc. Am. Acad.*, 35, 263–281.—In continuing the study of the colored substances formed by the action of sodium alcoholates on certain nitro compounds, the authors have succeeded in obtaining colored products by treating trinitranisol or trinitrobenzene with the sodium compounds of malonic ester, acetoacetic ester, phenol, and benzyl cyanide. The compounds containing malonic ester and acetoacetic ester are stable and were found on analysis to consist of three molecules of the sodium salt of the ester combined with one of the trinitro compound. Similar experiments with sodium methylate, ethylate, or amylate and trinitrobenzene led to analogous results. The formation of compounds of this composition is noteworthy, since all the substances prepared heretofore have contained the constituents in equal molecular proportions. The compounds were obtained as highly colored precipitates by treating a solution of the nitro compound in benzene with the sodium salt of the ester made by the action of sodium on the ester in the absence of alcohol. The compounds are decomposed by dilute acids, giving the aromatic constituent unaltered, and by alcohols. When the methyl compound is allowed to stand with benzyl alcohol, the methyl groups are replaced by benzyl. The compound so formed is converted into the corresponding methyl derivative when it is boiled with methyl alcohol. Experiments with picramide, dinitroxylol, and trinitroxylol showed that an increase in the negative nature of the aromatic constituent, increases the tendency to form colored compounds. The presence of methyl groups, however, diminishes the tendency to form these com-

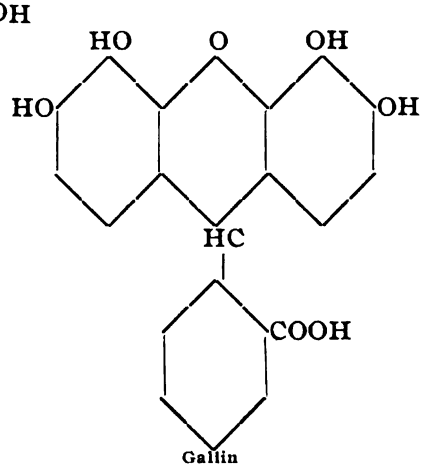
Digitized by Google

pounds. There was no color reaction with trinitromesitylene and sodium methylate. No colored compounds were obtained by the action of sodium alcoholates on aromatic bodies rich in negative groups, but containing no nitro groups. The authors conclude that the compounds are without doubt addition-products and not substitution-products, as suggested by Victor Meyer, and that the addition probably takes place at both the carbon and nitrogen atoms in the aromatic constituent.

The Constitution of Gallein and Coerulein. By W. R. Orndorff and C. E. Brewer. *Am. Chem. J.*, 23, 425–431.—A revision of the work on the reduction-products of gallein leads to the conclusion that hydrogallein and gallol are identical with gallin. Gallein is the phthalein of pyrogallol, and gallin is the corresponding phthalin. The following formulae are assigned to the compounds from a study of their esters :



Gallein



Gallin

Digitized by Google

A methyl and an ethyl ester were made by boiling gallein with the corresponding alcohol and a little sulphuric acid. Gallein triphenylcarbonate was prepared by heating gallein with phenyl isocyanate. Colored tetramethyl and tetraethyl ethers were also prepared. Gallein reacts as if it had the tautomeric, lactoid formula also, for it gives a colorless tetracetate, tetrabenzoate, and tetraphenylsulphonate. It also gives colorless tetramethyl and tetraethyl ethers. Its trimethyl ether resembles closely phenolphthalein in its properties. The constitution of gallin was shown by the fact that it gives a colorless tetracetate and pentamethyl ether. The tetracetate was proved to be an acid by the preparation of a silver salt. The pentamethyl ether has no acid properties and is easily saponified. Formulae for coerulein and coerulin are proposed, which bring out the relation of these compounds to anthragallol. A description of the above-mentioned compounds will be furnished later by the authors.

Researches on the Sodium Salts of the Amides. By Henry L. Wheeler. *Am. Chem. J.*, 23, 453-471.—A comparative study of the rate of formation of the sodium salts of the acid amides was made, in order to obtain additional evidence for the structure of these compounds, and to determine whether stereochemical interference was noticeable in the reaction. In working out the experimental details it was found necessary to devise a new method for the preparation of the sodium salts. When a boiling solution of the amide in benzene was treated with sodium amalgam, the reaction took place readily, and a number of compounds yielded sodium derivatives, which could not be obtained by the previously existing methods. To determine whether the velocity of salt formation is dependent on the relative acidity of the molecule, the anilides of formic, acetic, oxalic, and benzoic acids were studied. The results showed that there was no relation between the two quantities; the rate of the formation of the salt of oxanilide was, for example, only a little more than half that of formanilide. That basicity does not exert the most important influence, the acyl group being the same, was shown by experiments with benzamide, benzanilide, and benzoylbenzylamine. Ammonia and benzylamine have practically the same affinity constants, yet the velocity of salt formation with benzamide was nearly 100 times as great as that with benzoylbenzylamine. Experiments with a number of compounds to determine which of the two general forms, RNHCOH or HNHCOR, is more favorable for salt formation showed "that a disubstituted formamide gives a salt less readily than one that is monosubstituted, which would be expected from the theory of stereochem-

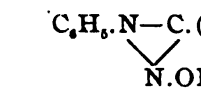
Digitized by Google

ical interference; and that when the larger or interfering radical is attached to nitrogen it has less effect in retarding the formation of sodium salts than when attached to the keto group. They, therefore, indicate that the sodium is attached to oxygen." The above statement does not always hold true, for it was found that the isomeric cycloamides, oxindol, and phthalimidine, were completely changed into their sodium salts, while, under the same conditions, benzoylbenzylamine was practically unchanged. Since stereochemical interference was found to have an influence on the reaction investigated, the amide of 2-4-6-trimethylbenzoic acid was studied. A sodium salt was readily prepared. As this acid is inactive in reactions which are supposed to involve an addition to the keto group, but does enter into reactions involving direct substitution, the fact that a sodium salt was formed from the amide points to the conclusion that, in the salt, the metal is joined to nitrogen. If this view is incorrect, then 2-4-6-trimethylbenzamide must, contrary to the theory of stereochemical interference, form an addition-product of the amide and sodium hydroxide, in the preparation of the sodium salt, in which the elements of the alkali are joined to the keto group. The elimination of water from such a compound would yield a sodium salt of the amide in which the metal is joined to oxygen. An experiment showed this to be the case. 2-4-6-Trimethyl- and 2-4-6-tribrombenzamide formed compounds with sodium hydroxide containing equal molecular quantities of the constituents. The addition-product containing bromine was prepared by pouring an excess of a solution of the amide in benzene on powdered sodium hydroxide. The fact that these addition-products have the elements of the alkali joined to the keto group and are not so-called molecular compounds, was shown by the action of benzoyl chloride on the sodium hydroxide addition-product of thioacetanilide, whereby acetanilide and thiobenzoic acid was formed.

Note on the Constitution of Diparabrombenzylcyanamide. By C. Loring Jackson and R. W. Fuller. *Am. Chem. J.*, 23, 494–500; *Proc. Am. Acad.*, 35, 231–236.—In order to obtain evidence of the structure of dialkylcyanamides, di-*p*-brombenzylcyanamide was prepared and studied, as this substance crystallizes well (m. p. 133°) and yields, on decomposition, a compound which can be obtained in a pure condition. When the cyanamide was treated with dilute sulphuric acid, dibrombenzylamine, ammonia, and carbon dioxide were formed. This reaction proves that the compound has the structure represented by the formula $R_2 : N.CN$ and not the possible imide structure, $R.N : C : N.R$.

Digitized by Google

On the Action of Nitrous Acid on Ethyl Anilinomalonate. By Richard Sydney Curtiss. *Am. Chem. J.*, 23, 509–511.—When ethyl anilinomalonate was suspended in water and treated with sodium nitrite and sulphuric acid, a thick amber-colored oil was obtained, which was extremely unstable. This oil did not give Liebermann's nitroso reaction, but showed marked acid properties. It yielded well crystallized, but unstable salts when treated with sodium or potassium hydroxide. By the action of acetic anhydride two crystalline substances were obtained. From the properties of the oil the author concludes that the compound has the following structure:



On Nitromalonic Aldehyde. By Henry B. Hill, Charles A. Soch, and George Oenslager. *Am. Chem. J.*, 24, 1–15.—In a former paper (*Am. Chem. J.*, 22, 89) it was shown that nitromalonic aldehyde readily reacts with acetone, and that the product formed is *p*-nitrophenol. This condensation of nitromalonic aldehyde with a number of ketones has been studied, and the conclusion is drawn that the reaction is a general one. Condensation took place most readily in dilute aqueous solution in the presence of a small amount of alkali. The reaction-mixture was allowed to stand twenty-four to forty-eight hours at ordinary temperatures, when the yield was almost quantitative. Methylethyl ketone gave on condensation nitrocresol ($CH_3$1,OH2, $NO_2$5). From dibenzyl ketone, 2,6-diphenyl-4-nitrophenol (m. p. 135°–136°) was prepared. This compound formed a potassium salt from which the corresponding anisol (m. p. 152°–153°) was prepared. The nitrophenol was reduced to an amido compound (m. p. 149°–150°), which was readily oxidized to diphenylbenzoquinone (m. p. 135°–136°) which in turn was reduced to a hydroquinone (m. p. 179°–180°). Nitromalonic aldehyde and acetoacetic ester gave nitrosalicylic acid (OH1,$COOH$2,$NO_2$4). With levulinic acid, 5-nitro-2-oxyphenylacetic acid, which melts at 160°–162° when rapidly heated, was obtained. If the acid is melted by prolonged heating at 148°–149° it is converted into its lactone (m. p. 187°–188°). The ethyl ester of the acid melts at 154°–155°. 2,6-Di-carboxy-4-nitrophenol, formed from nitromalonic aldehyde crystallizes with one molecule of water of crystallization, melts when anhydrous at 213°–214°, and is converted by fuming nitric acid into picric acid.

Digitized by Google

The Preparation of Zinc Ethyl. By ARTHUR LACHMAN. *Am. Chem. J.*, **24**, 31–39.—Detailed directions for the preparation of zinc ethyl in quantity are given. The zinc-copper couple used is made by reducing a mixture of 100 parts of zinc dust and 12 parts of copper oxide powder in a stream of hydrogen. The results of a number of experiments show that the method is rapid and gives an excellent yield. The author gives some valuable information in regard to the manipulation of zinc ethyl.

The Reactions of Aniline and Hydroxylamine with Hydroxy- and Unsaturated Compounds. By ALFRED TINGLE. *Am. Chem. J.*, **24**, 45–60.—The author has undertaken an investigation of the characteristic reactions of the group —CH : C.OH. As the group under investigation contains two reactive elements, a double bond and a hydroxyl group, it seemed best to study in the beginning, first a compound containing no double bond but a hydroxyl group which is rendered more active by the presence of a highly negative radical, and, second, a compound containing a double bond and a negative group. As examples of these two classes of bodies, ethyl tartrate and ethyl cinnamate were used. The action of aniline and of hydroxylamine on the substances was studied, but the results do not yet warrant any definite conclusions. When ethyl tartrate was boiled with aniline, tartranilide and a body which appeared to be ethyl phenyltartramate,

$$\begin{matrix} CH.OH.CO_2C_2H_5 \\ | \\ CH.OH.CO.NHC_6H_5 \end{matrix}, \text{(m. p. } 151^\circ\text{–}152^\circ\text{)}$$

were formed. This reaction shows that the hydroxyl group, under these conditions, is inactive toward an amine. The ester did not react with hydroxylamine in a number of experiments. Aniline was found to react with neither ethyl nor sodium cinnamate. With hydroxylamine, however, there was a complicated reaction which led to the formation in aqueous solution, of an oil, which is at present under investigation, and phenylisoxazolone. When aniline was boiled with methyl salicylate the products were phenol and methylaniline. As the yield is very good the author proposes to extend the reaction to the preparation of other alkylanilines.

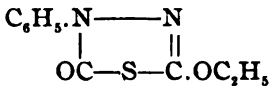
On the Molecular Rearrangement of the Thioncarbamic, Thioncarbanilic, and Thioncarbazinic Esters: β-Alkyl-α-μ-diketotetrahydrothiazoles. By HENRY L. WHEELER AND BAYARD BARNES. *Am. Chem. J.*, **24**, 60–83.—It has already been shown by the authors that thioncarbamic esters, $H_2N.CS.OR$

Digitized by Google

are readily converted into the isomeric thiol compounds, $H_2N.CO.SR$, by the action of alkyl halides. In the present paper are given the results of an examination of certain thion esters, XHN.CS.OR, under the same conditions. The experiments led to the preparation of some homologues of α-μ-diketotetrahydrothiazole and of sulphocyanacetic acid. When X in the above formula is C_6H_5, the compounds, thioncarbanilic esters, react less readily with alkyl halides than the thioncarbamic esters. When X is the group C_6H_5NH, however, the compounds, thioncarbazinic esters, react with great ease with both alkyl and acyl halides. To prepare phenyl thioncarbazinic ester, ethyl dithiocarbonate was treated with phenylhydrazine. In addition to the compound sought, the hydrazone $C_6H_5NH.N : C.SC_2H_5.OC_2H_5$ was obtained. When this hydrazone is treated with thiobenzoic acid, the compounds unite at the double bond and subsequently break down with the formation of phenylthiolcarbazinic ester and ethyl thiolbenzoate. The hydrazone can be converted into thioncarbazinic ester by the action of hydrogen sulphide or hydrogen chloride. The reaction involves the formation of addition-products and the subsequent elimination of ethyl mercaptan and ethyl chloride respectively. The addition-product containing hydrogen chloride was isolated. The hydrazone reacts energetically with acetyl and benzoyl chlorides. With the latter compound an addition-product is formed, which breaks down into ethyl chloride and the compound

$$C_2H_5S.CO.NH.N.C_6H_5.COC_6H_5.$$

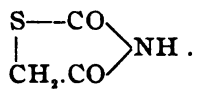
Phenylthioncarbazinic ester is converted at ordinary temperatures into the corresponding thiol compound by alkyl halides. It reacts with phosgene giving ethoxyphenylthiobiazolone,



and gives a benzoyl derivative of the following structure :

$$C_6H_5.C_6H_5CO.N.NH.CS.OC_2H_5.$$

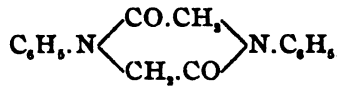
The action of chloracetic acid on ethyl thioncarbamate is analogous to that of the alkyl halides : an addition-product is first formed, which loses ethyl chloride and is thus converted into carbaminthiolglycollic acid, $H_2N.CO.SCH_2.CO_2H$. This derivative of glycollic acid loses water and passes into α-μ-diketotetrahydrothiazole,



Digitized by Google

Derivatives of the above compound were prepared by replacing chloracetic acid by other halogen-substituted acids in the fatty series, and by the action of hydrochloric acid on the α-sulphocyan derivatives of the fatty acid esters. Reference must be made to the original paper for a more detailed account of the compounds mentioned and a description of a large number of esters of α-sulphocyanacetic acid and its homologues.

Formation of Indigo from Diphenyldiketopiperazine. By M. KUHARA AND M. CHIKASHIGÉ. *Am. Chem. J.*, 24, 167–171.—When diphenyldiketopiperazine,



prepared from chloracetanilide and potassium hydroxide, was cautiously fused with potassium hydroxide, it was converted into a brown substance, which, on solution in water, was rapidly changed into indigo. It is probable that in the reaction phenylglycocoll was first formed and that this, by the action of the alkali, went over to pseudoindoxyl which in turn was converted by the oxygen of the air into indigo. This synthesis explains the formation of indigo from bromacetanilide.

The Action of Nitric Acid on Vanillin. By WILLIAM B. BENTLEY. *Am. Chem. J.*, 24, 171–181.—Nitric acid even in a 5 per cent. solution, does not oxidize vanillin, but converts it into a mixture of nitrovanillin, dihydrodivanillin, and dinitroguaiacol. Under the proper conditions a good yield of nitrovanillin is obtained. The compound melts at 176°, and forms insoluble chromium, copper, and lead salts, and a potassium salt which crystallizes with one molecule of water of crystallization. Nitrovanillin is converted by nitric acid into dinitroguaiacol; its structure is, therefore,

$$C_6H_2.CHO.OCH_3.OH.NO_2(1,3,4,5).$$

By cautious treatment with potassium permanganate, nitrovanillin was oxidized to nitrovanillic acid, which was found to melt, after careful purification, at 216° and not at 202°, the melting-point assigned to it by previous investigators. The acid crystallizes with 1½ molecules of acetic acid.

Digitized by Google

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

Lecture Experiments. Reversible Chemical Reactions. BY W. LASH MILLER AND F. B. KENRICK. *J. Am. Chem. Soc.*, **22**, 291–300.—The mass-action law is qualitatively illustrated by six groups of experiments on the equilibrium of reactions familiar to students of elementary inorganic chemistry. The manipulation is decribed in detail; but in several instances it is not clear what the experiment is intended to illustrate; thus it is not apparent that the mass-action law requires that dilution with water should cause precipitation of silver bromide or of cupric hydroxide from their ammoniacal solutions, nor that the former salt should be precipitated by silver nitrate and potassium bromide, except through a consideration of the electrolytic dissociation theory, to which no reference is made by the authors.

Notes on Lecture Experiments to Illustrate Equilibrium and Dissociation. BY JULIUS STIEGLITZ. *Am. Chem. J.*, **23**, 404–408.—The first experiment described consists in sealing 0.029 gram bromine, in glass tubes of 40 cc. capacity, in one case with an equal molecular quantity of phosphorus tribromide (or trichloride), and in another case with nine (or six) times as much of these substances, and heating the tubes side by side in a beaker of water to 80°–90° (or 40°–55°). The brown color of the bromine vapor is much deeper in the tubes containing no excess of the phosphorus compound. The other experiments relate to electrolytic dissociation, and consist in showing that the color produced by adding a little ammonia to phenolphthalein or litmus solution is greatly weakened by the addition of concentrated ammonium chloride solution, owing to the reduction of the dissociation of the ammonium hydroxide.

On a Minimum in the Molecular Lowering of the Freezing-Point of Water, Produced by Certain Acids and Salts. BY VICTOR J. CHAMBERS AND JOSEPH C. W. FRAZER. *Am. Chem. J.*, **23**, 512–520.—The investigation is a continuation of that of Jones and Chambers (*this Rev.*, **6**, 72), and the results obtained are entirely similar. The substances investigated cryoscopically were copper sulphate, phosphoric acid, hydrochloric acid, sodium acetate, cadmium iodide, strontium iodide, and zinc chloride. All of them except the first show a marked minimum in the molecular lowering at concentrations between 0.05 and 0.5 mol per liter. The authors consider that the results further confirm the explanation, previously offered, that the quantity of solvent is reduced by the combination of it with the dissolved substance to form a hydrate.

Digitized by Google

On the Freezing-Points of Aqueous Solutions of Non-Electrolytes. By E. H. Loomis. *Phys. Rev.*, 9, 257–287.—The method is essentially the same as that used by the author in his previous work (*this Rev.*, 3, 23), but an error due to a variation in the temperature of the stem of the thermometer is now eliminated. It is shown that no appreciable error is involved in the author's method by reason of a difference between the convergence temperature (Nernst and Abegg, *Ztschr. phys. Chem.*, 15, 681), and the true freezing-point, inasmuch as this difference was found by direct experiment to amount to only 0.004°. The molecular lowerings (calculated for 1 mol in a *liter* of *solution*) found by the author are given in the following table.

Solute.	Concentration in mols per liter.						
	0.01	0.02	0.05	0.10	0.20	0.50	1.00
Methyl alcohol.....	1.83	1.81	1.82	1.82	1.83	...	...
Ethyl alcohol	1.81	1.84	1.84	1.85	1.85	...	...
n-Propyl alcohol	1.89	1.86	1.87	1.86	1.86	...	...
n-Butyl alcohol	1.89	1.84	1.85	1.86	1.86	...	...
Amyl alcohol	1.85	1.86	1.85	1.845	...	...	...
Glycerine	1.86	1.86	1.86	1.87	1.88	...	...
Dextrose.....	1.88	1.84	1.86	1.88	1.90	...	...
Cane-sugar.....	1.87	1.89	1.89	1.92	1.98	..	...
Mannite	1.85	1.86	1.86	1.87	1.90	1.97	...
Acetone.....	1.85	1.86	1.86	1.85	1.85	...	1.91
Chloral hydrate	1.86	1.87	1.85	1.87	1.88	...	2.05
Aniline	1.85	1.86	1.83	1.81	1.77	...	...
Ether.....	1.62	1.68	1.71	1.73	1.73	...	...

From plotting the results the author concludes that all the investigated substances exhibit at extreme dilution a constant molecular lowering of the value 1.86°, with the exception of the three substances methyl alcohol, ethyl alcohol, and ether, for which the extrapolated values are 1.82°, 1.84°, and 1.50° respectively. The author suggests that these apparent exceptions may arise from an error consisting in the evaporation of these volatile solutes out of their aqueous solutions during the experiment, but he has not adequately tested this explanation, which seems an entirely reasonable one, especially in the case of ether, which exhibits the most serious anomaly. Nevertheless, the investigation as a whole furnishes a comprehensive and most exact verification of the Raoult-van't Hoff principle and of van't Hoff's thermodynamical formula, by which the molecular freezing-point lowering for water is calculated to be 1.87°. Finally it is worthy of note that the deviations from this value rarely exceed about 1 per cent. even in solutions containing as much as 0.1 mol per liter.

Digitized by Google

A Revision of the Atomic Weight of Iron. By THEODORE WILLIAM RICHARDS AND GREGORY PAUL BAXTER. *Proc. Am. Acad.*, 35, 253–260.—Ferric oxide made in two different ways, was ignited at 900° in a current of air, weighed, and then reduced in a current of electrolytic hydrogen at 900°. Two determinations with oxide prepared from precipitated ferric hydroxide gave 55.900 as the mean value of the atomic weight, and five determinations with oxide made from ferric nitrate gave on the average 55.883, the last value being considered nearest the truth. Experiments are described which prove that the ferric oxide occludes no appreciable amount of gas, and the same had been previously shown to be true of iron ignited in hydrogen. Previous determinations are criticized at the close of the article; and the errors which led to the higher value (56.0) commonly adopted are suggested.

On the Determination of Sulphuric Acid in the Presence of Iron : A Note on Solid Solutions. By THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, 35, 377–383.—The author maintains, on the basis of the previously published experiments, that the precipitation of iron with barium sulphate is due to the occlusion, at the moment of the separation of the precipitate, of a complex basic compound of iron and sulphuric acid analogous to the well-known compound of chromium, and that the amount occluded will be dependent upon the amount of the complex salt present in the solution, in accordance with the distribution law.

The Driving Tendency of Physico-Chemical Reaction and Its Temperature Coefficient. By THEODORE WILLIAM RICHARDS. *J. Phys. Chem.*, 4, 383–393; *Proc. Am. Acad.*, 35, 471–480.—The author first discusses the relations between the two familiar van 't Hoff equations :

$$\frac{d}{dt} ln \frac{c_1^{n_1} c_1'^{n_1'} \cdots}{c_2^{n_2} c_2'^{n_2'} \cdots} = \frac{U}{RT^2} \text{ and } \frac{d}{dt} ln \frac{p_1^{n_1} p_1'^{n_1'} \cdots}{p_2^{n_2} p_2'^{n_2'} \cdots} = \frac{-\lambda}{RT^2}.$$

He emphasizes the advantages of the latter, designating it the reaction isobar, since λ represents the absorption of heat when the reaction takes place under constant external pressure. A further equation, designated the reaction metatherm, is derived, which includes both the case of a reaction at constant pressure and that of one at constant volume. In the latter part of the article it is suggested that there may be theoretical advantages in considering the equilibrium ratio, or constant (k) resolved into separate constant factors ($z_1, z_1' \cdots$) characteristic of each of the reacting substances, of whose reciprocals the constant shall be the same function as it is of the partial pressures; that is

Digitized by Google

$$k = ln\frac{p_1^{n_1}p_1'^{n_1'}\cdots}{p_2^{n_2}p_2'^{n_2'}\cdots} = ln\frac{z_2^{n_2}z_2'^{n_2'}\cdots}{z_1^{n_1}z_1'^{n_1'}\cdots}.$$

The factors $z_1, z_1' \cdots$ are designated "single physico-chemical potentials," and the constant k is called "the driving tendency of the reaction," since it is regarded "as an opposing pressure tendency just equal to the ratio of the pressures actually observed."

A Table of Atomic Weights of Seventy-four Elements. By THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, 35, 621.—The only changes, aside from the number of figures retained, from the table published by the same author two years ago (*this Rev.*, 4, 119), and the only important differences from the values recently adopted by Clarke (*this Rev.*, 6, 72), are shown below:

	1898.	1900.
Boron	10.95	11.0
Calcium	40.0	40.1
Iron	56.0	55.9
Selenium ...	79.0	79.2
Tungsten ...	184.4	184.

	Richards.	Clarke.
Antimony	120.0	120.4
Cerium	140.	139.0
Iron	55.9	56.0
Magnesium ..	24.36	24.3
Palladium ...	106.5	107.0
Strontium ...	87.68	87.60

A Preliminary Investigation of the Conditions which Determine the Stability of Irreversible Hydrosols. By W. B. HARDY. *J. Phys. Chem.*, 4, 235–253.—The author has shown that the particles of heat-modified proteid or egg-white in the form of a hydrosol (that is, in the form of an aqueous colloidal solution) are electropositively or electronegatively charged and move towards the one electrode or the other when subjected to the influence of a high difference of potential, according as the solution is acid or alkaline; and that in neutral solution the electric field has no influence, in which case the particles and the fluids are said to be isoelectric. The isoelectric point is of great importance since it is also the point of minimum stability or of most ready coagulation of the hydrosol, this principle being generally applicable to hydrosols, in spite of the great differences in stability towards chemical agents which different ones exhibit. The article is, however, mainly devoted to the effect of various salts, acids, and alkalies in coagulating hydrosols. The author derives from his experiments the new principle that the coagulation is determined by that one of the two ions which has an electric charge opposite in sign to that of the colloidal particle; and confirms the conclusion previously drawn by others that bivalent ions are enormously more active in causing coagulation than univalent ones, and that trivalent ions again are far more active than bivalent ions. In proof of this principle it is

Digitized by Google

shown that dialyzed silica, proteid in presence of a trace of alkali, dialyzed mastic, and colloidal gold, whose particles are all electronegative, are coagulated at once or in a relatively short time by aluminum sulphate, copper sulphate, or chloride, cadmium nitrate, barium chloride, and magnesium sulphate, but are not coagulated by equivalent solutions of potassium or sodium sulphate or of sodium chloride; while proteid in the presence of a trace of acid and dialyzed ferric hydrate, whose particles are electropositive, are coagulated at once by all the sulphates investigated, namely those of aluminum, copper, magnesium, potassium and sodium, but not by the chlorides of copper, barium, or sodium, nor by the nitrate of cadmium. The salt concentration necessary to coagulate ferric hydrate was found to be 1/4000 mol per liter in the cases of potassium and magnesium sulphate, but 1/10 to 1/50 mol in the cases of the chlorides of sodium and barium and the nitrate of cadmium; similar concentration results are given also in the case of gum mastic and of colloidal gold. In accordance with the author's principle is also the behavior of acids and alkalies, for the concentration necessary for the coagulation of negative colloid particles by acids or of positive particles by bases is shown to be that at which the various acids or bases have the same specific conductivities and, therefore, approximately the same concentration of hydrogen or hydroxyl ions. On the other hand, the effect of acids on positive particles or of bases on negative particles, though somewhat irregular, is clearly dependent on the valence of the negative and positive ions respectively. A series of experiments is also given on the concentration of potassium sulphate necessary to produce coagulation of colloidal gold in solutions containing acetic acid or ammonia in various amounts. The article closes with a summarized statement of results, interspersed with hypothetical considerations.

On the Mechanism of Gelation in Reversible Colloidal Systems. By W. B. Hardy. *J. Phys. Chem.*, 4, 254–273.—From a study of gelatine-water-alcohol and agar-water mixtures it is concluded that, in accordance with the view of van Bemmelen (*Ztschr. anorg. Chem.*, 18, 20), the jellies or gels produced by cooling consist of a framework of solid material within which is enclosed a fluid. Further details of the structure are also described. The solid can be separated from the fluid by gentle pressure. The composition of the two phases was determined in the case of the agar-water mixture for different proportions of the components and for different temperatures, and was found to vary with both of these conditions, a fact seemingly inconsistent with the phase rule, to account for which hypotheses are sug-

Digitized by Google

gested by the author. The composition of the phases was also found to depend greatly on whether the final temperature was reached from a higher or lower temperature, there being a marked lagging effect.

Vapor-Pressure Relations in Mixtures of Two Liquids, I and II. By A. Ernest Taylor. *J. Phys. Chem.*, 4, 290–305; 355–369.—These papers describe an experimental investigation of the vapor-pressure of mixtures of acetone and water at various temperatures, and of the composition of the vapor from such mixtures. Part I is devoted to a description of the apparatus and methods employed. The main feature of the vapor-pressure method, which consisted in determining the boiling-point under measured pressures, is considered to be the arrangements for the avoidance of superheating; a large quantity of a mixture of garnets with scrap platinum or with silver tetrahedra was placed in the boiling vessel, and this was submerged, up to the level of the liquid within, in a water-bath kept 8° above the boiling-point. The composition of the vapor was determined in a separate operation by distilling off 20 cc. from a 220 cc. portion of the mixture, and determining the boiling-point of this distillate under atmospheric pressure. Part II contains the experimental results together with their graphical representations and reductions of them for even temperatures and pressures. The boiling-points of pure water and acetone and of mixtures of them varying successively by 10 per cent. in composition, were determined at a large number of different pressures lying between 115 mm. and 715 mm. The composition of the distillate was determined for each mixture at two pressures, 200–250 mm. and 740 mm. The discussion of the results is reserved for a third paper.

On the Determination of Transition Temperatures. By H. M. Dawson and P. Williams. *J. Phys. Chem.*, 4, 370–382.—In order to determine the transition temperature of hydrated salts, the authors have measured in the neighborhood of the temperature, instead of the composition, the *density* and *electrical conductivity* of solutions saturated with each of two solid phases, and by plotting the results have tried to locate the point of intersection of the two curves. The property of density was shown to give entirely satisfactory results with sodium sulphate; but this was not true of the electrical conductivity, for in such concentrated solutions this property changes very slowly with the concentration. This gives good results with less soluble salts, however; as was shown by experiments with sodium sulphate. Incidentally an apparatus is sketched and described for the determination of the conductivity of hot saturated solutions; and

Digitized by Google

the transition temperatures of $Na_2SO_4.10H_2O$, $MnCl_2.4H_2O$, and $Th(SO_4)_2.9H_2O$ are determined to be 32.38°, 58°–59°, and 47°–48°.

The Allotropic Forms of Selenium. By A. P. Saunders. *J. Phys. Chem.*, 4, 423–513.—The larger part of this lengthy paper is devoted to a list of references to previous articles relating to the properties of the various forms of the element selenium, and to abstracts of those articles. The author concludes from his investigation that selenium exists in three distinct forms, the liquid (including vitreous, amorphous, and soluble selenium), the red crystalline form, and the gray crystalline or metallic form. The new experiments described consist first of a large number of dilatometric measurements, by which it is shown that the metallic form is the stable one up to 220°, where it melts, it showing no tendency below that temperature to go over into any other form; and that vitreous selenium remains for years unaltered at the ordinary temperature, but goes over into the metallic form at 60°–80°, though occasionally it may, by rapid heating, be brought to 180° before changing. The results are then given of qualitative experiments on the effect of a large number of liquids on amorphous selenium, one group of them transforming it into the red crystalline form, another group, composed exclusively of nitrogen compounds, changing it into the metallic form, and the third group, consisting of water and aqueous solutions, having no influence. Experiments are also described which make it probable that the red crystals have an instable melting-point at 170°–180°. Finally a critical consideration of previous results and of some experiments of his own leads the author to adopt as the most probable specific gravity values, 4.26 for the amorphous, 4.28 for the vitreous, 4.47 for the red crystalline, and 4.80 for the metallic form.

An Exposition of the Entropy Theory. By J. E. Trevor. *J. Phys. Chem.*, 4, 514–528.—The author claims to have given a rigorous mathematical deduction of the entropy principle without any reference to the properties of gases.

Entropy and Heat Capacity. By J. E. Trevor. *J. Phys. Chem.*, 4, 529–532.—The conclusion is reached that "a system's entropy, plus its heat capacity with reference to any reversible path, is equal to the change per degree, on the same path, of the system's store of heat."

The Relation of the Taste of the Acid Salts to Their Degree of Dissociation, II. By Louis Kahlenberg. *J. Phys. Chem.*, 4, 533–537.—The author attempts to confute the explanation

Digitized by Google

advanced by Richards (*this Rev.*, 6, 121) and the reviewer (*this Rev.*, 6, 73) of the fact that the sour taste of acids and acid salts is not proportional to the concentration of the hydrogen ions in their solutions. That the author has entirely failed to understand that explanation will be evident when it is stated that the experiment which he brings forward to disprove it consists in causing a hydrochloric acid solution, so weak as not to taste sour when tasted in the ordinary manner, to remain long in motion in contact with the tongue, with the result that no sour taste is thereby developed.

The Eighth Group of the Periodic System and Some of Its Problems. By James Lewis Howe. *Proc. Am. Assoc. Advancement Sci.*, 49; *Science*, 12, 20–34.—This paper is a vice-presidential address in which the history of our knowledge of the platinum metals and their compounds is briefly presented.

Digitized by Google

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. No. 11.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. G. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F H. Thorp.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

A Process for the Determination of Carbon Dioxide in Carbonates. BY R. E. DIVINE. *J. Am. Chem. Soc.*, **22**, 473–476. The apparatus prescribed is of simple construction, including only two flasks with easily obtainable accessories. The air is expelled from one of the flasks by filling it with steam, and after cooling, the carbon dioxide liberated from the carbonate in the other flask, by means of sulphuric or tartaric acid, is collected in the first-named flask. Barium hydroxide solution is then introduced, and, after shaking to absorb the carbon dioxide, the excess of the hydroxide is determined.

A Method for the Rapid Gravimetric Estimation of Lime. BY W. H. HESS. *J. Am. Chem. Soc.*, **22**, 477–478.—The lime is precipitated as oxalate; this precipitate is ignited to destroy the filter, and the residue treated with ammonium nitrate and ammonium sulphate. Heating is continued until ammonium salts are expelled, and the lime is weighed as sulphate.

Note: The Employment of Ammonium Molybdate as a Test for Tin. BY J. P. LONGSTAFF. *J. Am. Chem. Soc.*, **22**, 450–451.—The author points out that he had already published a paper on this subject (*Chem. News*, **79**, 282) prior to the publication of Rogers' article (*J. Am. Chem. Soc.*, **22**, 220). The work of the two chemists is in substantial agreement.

Note: The Adulteration and Analysis of the Arsenical Insecticides. BY J. K. HAYWOOD. *J. Am. Chem. Soc.*, **22**, 568–582.

Digitized by Google

— The paper contains a résumé of the results of the analyses of the important insecticides of this class, and a description of methods of analysis which have given satisfactory results in the author's hands.

Note: Qualitative Tests for Boracic Acid. By E. M. Wade and M. L. Wade. *J. Am. Chem Soc.*, **22**, 618.—The substance to be tested is treated with hydrochloric acid and wood alcohol, the solution concentrated, and turmeric paper is held in the vapors. The paper, upon treatment with dilute ammonia, turns deep purple or blue.

F. J. Moore, Reviewer.

Estimation of Alkali Carbonates in the Presence of Bicarbonates. By Frank K. Cameron. *Am. Chem. J.*, **23**, 471–486.—The author finds existing methods unsatisfactory, and recommends that such solutions be titrated with a solution of acid potassium sulphate. Certain precautions are necessary in order to obtain a satisfactory end-point, owing to the instability of bicarbonates in solution. The method has the practical advantage that alkali and chlorine may be determined in the same sample.

Silicon in Ferrosilicon, II. By Fred. W. Bauer. *Iron Age*, **65**, (No. 22) 11.—The author compares six methods for the determination of silicon in ferrosilicon, and reaches the conclusion that methods involving the fusion of the sample with sodium carbonate should be abandoned, as yielding too low results.

The Assay of Antimony. By Arthur Chippendale. *Eng. Min. J.*, **69**, 553.—Native oxides of antimony are readily dissolved by boiling in concentrated hydrochloric acid, with the occasional addition of crystals of potassium iodide. In the solution the antimony may be determined by familiar methods.

The Electrolytic Determination of Copper. By William E. Grainger. *Eng. Min. J.*, **69**, 558.—The article gives an account of the methods by which ores are prepared for analysis at the laboratory of the "Ducktown Copper and Iron Co. Limited." The arrangement of their electrolytic apparatus is also described.

Separation and Determination of Mercury as Mercurous Oxalate. By C. A. Peters. *Am. J. Sci.*, **149**, 401–406.—The author sums up the results of his work as follows: "Mercurous nitrate may be estimated volumetrically by precipitating as oxalate and determining the excess of precipitant with permanganate. The precipitated mercurous oxalate may be estimated gravimetrically, by drying over sulphuric acid and weighing directly." Separations of mercurous salts from small quantities of

Digitized by Google

mercuric compounds may also be made, but the difficulties increase with the amount of mercuric salts present.

On the Qualitative Separation of Nickel and Cobalt by the Action of Ammonium Hydrate on the Ferricyanides. By PHILIP E. BROWNING AND JOHN B. HARTWELL. *Am. J. Sci.*, 150, 316–317.—The method of Clarke (*Am. J. Sci.*, 48, 67) is improved by the addition of the solution of an aluminum salt.

Iodometric Estimation of Arsenic Acid. By F. A. GOOCH AND JULIA C. MORRIS. *Am. J. Sci.*, 150, 151–157.—Soluble arsenates are treated with sulphuric acid and potassium iodide in slight excess. The bulk of the liberated iodine is expelled by boiling, and the solution finally bleached by the careful addition of sulphurous acid. After neutralization with sodium hydrate and acid carbonate, the resulting arsenite is titrated with iodine solution in the usual way. Earlier methods based upon the same reaction are critically discussed.

HENRY FAY, REVIEWER.

Note on a Qualitative Test for Tin. By CHARLES BASKERVILLE. *J. Elisha Mitchell Sci. Soc.*, 16, 80–81.—The test involves the application of Longstaff's method, which depends upon the blue color produced when stannous chloride reacts with molybdic acid. Compare the abstract above relating to the same subject.

J. F. NORRIS, REVIEWER.

The Elementary Analysis of Organic Substances Containing Nitrogen. By FRANCIS GANO BENEDICT. *Am. Chem. J.*, 23, 334–353.—In order to prevent the formation of oxides of nitrogen in the combustion of organic substances containing nitrogen, the compound to be analyzed is burned with a known weight of sugar or benzoic acid. After the substance has been charred in the closed tube, oxygen is admitted to oxidize the non-volatile residue and the copper that has been reduced by the volatile products of the dry distillation. The results of a large number of analyses made under these conditions prove that no oxides of nitrogen, which interfere with accurate results, are formed. The method does away with the use of a reduced copper spiral and so facilitates the analysis of nitrogenous substances. The use of sugar or benzoic acid in the analysis of compounds containing nitrogen which is not united to oxygen, is not necessary, for they can be burned without the formation of oxides of nitrogen, if they are charred, in the manner described above, before oxygen is admitted to the tube. The analysis of a compound containing a number of nitro groups can be readily effected by mixing the sub-

Digitized by Google

stance with finely powdered silica. The silica not only prevents an explosion, but also materially assists in reducing the oxides of nitrogen formed.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

On the Isomorphism of Selenium and Tellurium. BY JAMES F. NORRIS AND RICHARD MOMMERS. *Am. Chem. J.*, 23, 486–494.—The isomorphism of the double bromides of selenium and dimethylamine with the corresponding tellurium compound was studied by bringing together in succession saturated solutions of these two colored salts with the colorless double chloride of tellurium and dimethylamine. According to the method of Retgers, isomorphism exists when the color of the crystals varies gradually from one side to the other, the crystals of the pure compounds being visible on the extreme edges of the mass. If, however, the salts are not isomorphous, they do not mix, and in the center where the two solutions have been brought together, distinct crystals of each compound may be seen, owing to their difference of color. The double chloride of tellurium and dimethylamine gave mixed crystals of varying depths of color with both the selenium and the tellurium double bromide, showing the isomorphism of both bromides with the chloride, and consequently with each other. As it has been suggested that tellurium salts are isomorphous with those of the platinum group of metals, the double bromide of platinum and dimethylamine was tested in the same manner, using again the double chloride of tellurium and dimethylamine. In this case the two compounds crystallized out separately, disproving the isomorphism of the platinum compound with those of selenium and tellurium. During the investigation the following double salts of tellurium were isolated: $3TeCl_4.TeOCl_2.4(CH_3)_2NH.HCl.H_2O$, $TeCl_4.TeOCl_2.2(CH_3)_2NH.HCl.H_2O$, $TeCl_4.2TeOCl_2.3(CH_3)_2.NH.HCl$, $TeCl_4.2(CH_3)_2NH.HCl$, $TeBr_4.2(CH_3)_2NH.HBr$. It is thus shown that tellurium, as well as selenium, forms double salts which contain the oxychloride of the metal. The first three salts can be considered as derivatives of the salt $TeCl_4.(CH_3)_2NH.HCl$, in which a part of the tellurium tetrachloride has been converted into the oxychloride by the water in the solvent. Double salts of tellurium, analogous to the double salts of selenium and the perbromide of dimethylamine $(CH_3)_2.NH.HBr_2$, could not be obtained.

The Occurrence of Vanadium, Chromium, and Titanium in Peats. BY CHARLES BASKERVILLE. *J. Am. Chem. Soc.*, 21,

Digitized by Google

706.—In the ash from three samples of peat, all presumably from Hyde Swamps, N. C., small quantities of titanium, chromium, and vanadium were found.

A Study of Certain Double Chromates. By W. G. Haywood. *J. Elisha Mitchell Sci. Soc.*, **16**, 56–59.—By crystallizing solutions of the alkali carbonates with the alkali bichromates, the following salts were isolated: $NaNH_4CrO_4.2H_2O$, $2Na_2Cr_4O.(NH_4)_2CrO_4.4H_2O$, $3K_2CrO_4.Na_2CrO_4$, $K_2CrO_4.MgCrO_4.2H_2O$. The properties of these salts were not studied.

On the Effect of Very Low Temperatures on the Color of Compounds of Bromine and Iodine. By J. H. Kastle. *Am. Chem. J.*, **23**, 500–505.—In a previous paper (*this Rev.*, **6**, 62) the author has shown that the color intensity of the halogens is in inverse ratio to their chemical activity, and that the halogen compounds which are least stable are the most highly colored. It was then assumed that the color of these compounds was due to dissociation. This idea is considered to be confirmed by the experiments described in the present paper. The following compounds were subjected to a temperature of —190° in a Dewar tube immersed in liquid air: Lead iodide, phosphorus pentabromide, phosphorus heptabromide, mercuric bromide, iodoform, benzene, dibromsulphonamide, tribromphenol bromide, and mercuric iodide. In each case the color of the compound became markedly lighter on cooling, the change being, in some cases, very decided. It would seem to be generally true that all colored substances become lighter on cooling to low temperatures, but the change of color cannot be due in all cases to the same causes which produce it in the bromides and iodides. By cooling simultaneously the yellow and red varieties of mercuric iodide, it was found that the yellow mercuric iodide became white or very pale yellow, and that the red changed to orange-yellow, from which facts the author concludes that the low temperature does not change the red variety to the yellow variety stable above 128°, but simply changes its color in a manner characteristic of other colored bromides and iodides.

On the Supposed Allotropism of Phosphorus Pentabromide. By J. H. Kastle and L. O. Beatty. *Am. Chem. J.*, **23**, 505–509.—It has been found that the red crystals which have been supposed to be an isomeric form of phosphorus pentabromide are in reality phosphorus heptabromide. The two substances behave differently towards water. The yellow phosphorus pentabromide, when brought in contact with water, changes to the oxybromide and afterwards dissolves. The red heptabromide dissolves apparently without the production of the oxybromide

Digitized by Google

and gives a solution which has the color of bromine water, the color of which can be removed by carbon disulphide. It is further shown that heat is evolved when bromine is added to phosphorus pentabromide, and that by adding a small quantity of phosphorus tribromide to the red compound it is changed to the yellow compound according to the equation $PBr_7 + PBr_3 = 2PBr_5$. Phosphorus heptabromide has been obtained in the form of bright red, transparent, prismatic crystals which may be resublimed, but which give up bromine on standing in contact with bromine absorbents.

Notes on Gold-Sodium Chloride. By LYMAN F. KEBLER. *J. Franklin Inst.*, 150, 235–237.—The following varying percentages of gold have been found in five samples of commercial gold-sodium chloride: 21.29, 24.68, 26.13, 29.02, 32.91.

Digitized by Google

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. No. 12.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. G. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

The Precipitation of the Sulphides of Nickel and Cobalt in an Alkaline Tartrate Solution, together with an Investigation into the Nature of Certain Tartrates of these Metals. BY O. F. TOWER. *J. Am. Chem. Soc.*, 22, 501–521.—The investigation is mainly a physico-chemical one. Nickel tartrate of the composition $NiC_4H_4O_6$, a solution of which is formed by digesting an excess of nickel hydroxide with cold dilute tartaric acid, was found, (1) by the freezing-point method, to have in 0.1 molar[1] solution a molecular weight nearly a third greater than that corresponding to the formula; (2) to have an exceptionally small electrical conductivity (at 0.01 molar concentration about one-third that of magnesium tartrate), which increases very rapidly with the dilution; and (3) to give rise, when nickel electrodes are placed in a 0.02 molar solution of it and a 0.1 molar one of nickel nitrate, to an electromotive force (0.048 volt), which corresponds to the presence of about 8 per cent. of the nickel in the form of its ions in the former solution. Corresponding measurements with potassium nickel tartrate, ($K_2NiC_8H_8O_{12}$), made by digesting nickel tartrate at 40° with potassium hydrogen tartrate and in other ways, showed an apparent molecular weight about one-third of that corresponding to the formula just given, a conductivity not very different from that of a sodium tartrate solution containing an equivalent amount of the alkali metal, and an electromotive force corresponding to the presence of only 0.2–0.3 per cent of nickel ions. All these facts are explained by the assumptions that the former salt exists largely as double molecules which are dissociated

[1] This word will be used in this Review, in accordance with the suggestion of Ostwald, to designate a concentration of one mol (one molecular weight in grams) per liter.

Digitized by Google

into Ni″ and O.CO.(CHOH)$_2$.CO.O.Ni.O.CO.(CHOH)$_2$.CO.O″ ions to a relatively small extent, and that the latter salt is almost completely dissociated into two K ions and this same complex nickel tartrate ion, this last ion being itself only very slightly dissociated at moderate dilutions, but appreciably so at very great dilutions. The author has also investigated the effect on the freezing-point of a neutral nickel tartrate solution of adding successive quantities of potassium hydroxide, but the results are so irregular, owing, perhaps, to the formation of a colloidal substance, which even separated as a jelly at one concentration, that the conclusions drawn from them in regard to intermediate compounds seem to the reviewer of little value. It may be mentioned, however, that when two mols of potassium hydroxide were added to one mol of $NiC_4H_4O_6$, the apparent molecular weight was found to be 185, while that corresponding to $K_2C_4H_2NiO_6$ is 283, thus showing that the double molecules in the pure nickel tartrate solution are finally resolved by the potassium hydroxide, as might be expected, into single ones, and that these are considerably dissociated. Electromotive-force measurements showed that nickel ions were not present in appreciable quantities in this solution.—Freezing-point and conductivity measurements in the case of the various corresponding cobalt compounds, gave analogous results. The conductivity of neutral cobalt tartrate in 0.06–0.02 molar solution is, however, nearly one-half greater than that of the nickel compound. Finally, the author shows that in the solution prepared by adding an excess of sodium hydroxide to nickel tartrate solution and saturating with hydrogen sulphide, nickel sulphide is probably present in the colloidal condition; for the solution polarizes light, and nickel sulphide is precipitated from it by the addition of gum-arabic and alcohol. The different behavior of cobalt, which is precipitated by the hydrogen sulphide, therefore arises merely from the much smaller tendency of its sulphide to remain in the colloidal condition. Villiers' method of separation, which is based on this difference of behavior, is regarded by the author to be unsatisfactory for several reasons.

The Relation between Structural and Magneto-optic Rotation. By A. W. Wright and D. A. Kreider. *Am. J. Sci.*, 156, 416–427.—Experiments have been made by the authors to determine whether the molecular structure or aggregation to which optical activity is due is influenced by causing the chemical substance or crystals to be produced in a magnetic field, which itself, as is well known, imparts temporary activity to all substances. The results obtained were negative in all cases, it being found that *d*-tartaric acid was converted into the active forms at the same rate whether it was heated with water in a magnetic or in a neutral field, that racemic acid does not

Digitized by Google

become active when heated in a magnetic field, and that sodium chlorate does not show any increased tendency to crystallize in either the dextro- or laevorotatory form in a magnetic field. It was, however, found that both kinds of crystals of this substance, and that also crystals of ferrous sulphate have a marked tendency to form more abundantly in the strongest part of the field. It was also found, contrary to the previous experiments of Pope and Kipping (*Chem. News*, **75**, 45), that the presence of an optically active substance (glucose) in the solution does not have any effect on the form of the sodium chlorate crystals produced.

Toxic Action of Acid Sodium Salts on Lupinus Albus. By LOUIS KAHLENBERG AND ROLLAN M. AUSTIN. *J. Phys. Chem.*, **4**, 553–569.—It is found that the toxic effect of the acid sodium salts of oxalic, tartaric, malic, succinic, and citric acids, on seedlings of *Lupinus Albus*, increases with the extent of their dissociation into hydrogen ions, but is very far from proportional to the concentration of these, as is shown especially by a comparison with the effect of hydrochloric acid. As in the case of their sour taste (*this Rev.*, **6**, 73), the physiological action of these salts is dependent, not only on the concentration of the hydrogen ions, but also on that of the salt as a whole.

Relationships between Thermodynamic Fundamental Functions. By J. E. TREVOR. *J. Phys. Chem.*, **4**, 570–584.—The author derives a large number of equations expressing the relations between the four fundamental functions, energy, free energy, the heat function, and the thermodynamic potential, both for the case of a system of definite masses and for the individual phases.

The Boiling-points of Mixtures of Chloral and Water. By JOSEPH C. CHRISTENSEN. *J. Phys. Chem.*, **4**, 585–597.—It is found that the addition of 5 per cent. of water to pure chloral causes a depression of its boiling-point by about 2°; about 5 per cent. more water then raises it to its original value; after which further additions raise the boiling-point very gradually to that of pure water, which is about 3° higher than that of pure chloral.

On the Emission and Absorption of Water Vapor by Colloidal Matter: Correction. By P. DUHEM. *J. Phys. Chem.*, **4**, 598.—Two equations in the previous article with the same title (*this Rev.*, **6**, 74) are stated to be incorrect.

On the Position of Helium, Argon, and Krypton in the Scheme of the Elements. By WILLIAM CROOKES. *Am. J. Sci.*, **156**, 189–192.—The author points out that in his earlier

Digitized by Google

proposed arrangement of the elements (*J. Chem. Soc.*, 53, 502, 1888) at equi-distant intervals on an ascending curve of figure-eight horizontal projection, vacant spaces exist into which the new elements, helium, neon, argon, metargon, and krypton, are, in consideration of their properties, appropriately inserted.

H. M. GOODWIN, REVIEWER.

The Solution-tension of Zinc in Ethyl Alcohol. BY HARRY C. JONES AND ARTHUR W. SMITH. *Am. Chem. J.*, 23, 397–403.—From Kahlenberg's value of the electromotive force (0.195 volt) of the cell: Zn, 0.1 n $ZnCl_2$, alcoholic, 0.1 n ZnCl aqueous, Zn (see *this Rev.*, 6, 11), the authors calculate the value of the electrolytic solution-pressure of zinc in alcohol to be 1.9×10^{10}. From the same investigator's measurement of the absolute potential difference between zinc and a 0.1 normal alcoholic $ZnCl_2$ solution, 0.327 volt, the value is of the same order of magnitude, namely, 2.7×10^{10}. These calculations are based on a determination of the dissociation of $ZnCl_2$ in alcohol by the boiling-point method, which gave 6.5 per cent. for a 0.1 normal solution. The electrolytic solution-tension of zinc in water, as computed by Ostwald, is 10^{18}, thus about 10^8 times as great as the value in alcohol.

The Conductivity Temperature Coefficient of some Liquid Ammonia Solutions. BY EDWARD C. FRANKLIN AND CHAS. A. KRAUS. *Am. Chem. J.*, 24, 83–93.—Solutions of ammonium chloride, bromide, and iodide, of potassium iodide, of paranitrophenol, and of copper nitrate in liquid ammonia were sealed in thick-walled tubes provided with small platinum electrodes, and their molecular conductivity determined, over wide ranges of temperature. In all these cases, with rising temperature, the conductivity passed through a maximum. The same was found to be true for a solution of potassium iodide in methylamine. A solution of sulphur in ammonia showed a distinct conductivity at 139.5°, which is 6.5° above the critical temperature of ammonia. Solutions of potassium, sodium, and lithium in liquid ammonia have a positive temperature coefficient.

On the Electrolytic Deposition of Metals from Non-aqueous Solutions. BY LOUIS KAHLENBERG. *J. Phys. Chem.*, 4, 349–355.—Experiments were made on the deposition of silver from solutions of silver nitrate in pyridine, aniline, benzonitrile, quinoline, and acetone, and also on that of lead and antimony from non-aqueous solutions. Comparing the amount of silver deposited with that deposited in an ordinary silver voltameter connected in series with the electrolytic cell, it was found that the latter was uniformly higher, by nearly a per cent. in some cases. This discrepancy is

Digitized by Google

attributed to secondary reactions, as the silver-deposits from the non-aqueous solutions were usually discolored. It was found that silver could be completely separated electrolytically in compact form, from pyridine solutions, both pure and mixed with water. The work is stated to be only preliminary in character.

On the Weston Cell. By H. T. Barnes. *J. Phys. Chem.*, **4**, 339–349.—The author has investigated a number of Weston cadmium cells of various construction with reference to the change in their temperature coefficients, which the experiments of Kohnstamm and Cohen on the inversion point of cadmium sulphate in the neighborhood of 15° would lead one to anticipate. Their experiments all show the temperature coefficient of these cells to agree remarkably well between 15° and 40°, and that they are expressed well by the formula $E_t = E_{15} - 0.086\ (t - 15°)$. Between 0° and 15° different cells behave quite differently however, some of them showing an abrupt change in their temperature coefficient at about 2°, others between 8° and 15°, while still others showed no sudden change at all. The values of the electromotive force for different cells at 0° varied as much as two millivolts. The mean corrected ratio of the electromotive force of the Clark cells at 15° to that of the cadmium cells at 20° was found to be 1.40658, while Kahle gives the nearly identical value 1.40663. The reviewer would mention in this connection that Jaeger and St. Lindeck, of the Reichsanstalt (*Ztschr. phys. Chem.*, **35**, 98), have found cadmium cells containing a 13 per cent. amalgam wholly reliable above 10°, while Cohen (*Ztschr. phys. Chem.*, **34**, 621) claims they are unreliable below 23°. The concentration of the amalgam appears to have a decided influence on the constancy of the cells.

Electrolysis of Sodium Chloride. By C. G. L. Wolf. *J. Phys. Chem.*, **4**, 200–206.—The article describes a convenient apparatus for the electrolysis of solutions evolving gases at the electrodes, adapted for the laboratory and lecture room. The gases are separately collected, the apparatus kept at a uniform temperature in a thermostat, and the solution stirred. Its use is illustrated by an experiment on the electrolysis of sodium chloride.

A Chromium Cell for the Rectification of Alternating Currents. By J. Livingston R. Morgan and W. A. Duff. *J. Am. Chem. Soc.*, **22**, 331–334.—An electrolytic cell containing a ten per cent. sulphuric acid solution, a strip of platinum foil as cathode, and a fragment of metallic chromium as anode, was found to prevent the passage of a continuous current, if the external electromotive force was *gradually* increased, until the latter reached a value of 75 volts. The polarization is broken down at

Digitized by Google

this voltage and a current passes from chromium to platinum in the cell. The chromium electrode, however, then acquires the property of polarizing in the reverse direction; *i. e.*, a current in the reverse direction will now no longer traverse the cell from platinum to chromium until a certain voltage (which appears variable) is reached, when the cell is again broken down, a reversal takes place, and the chromium again becomes capable of opposing 75 volts when acting as anode. This remarkable behavior the authors attribute to the chromium passing from the "active" to the "inactive" state (Hittorf). The experiment is interesting in connection with the recent beautiful investigations of Ostwald on the periodic phenomena observed on dissolving chromium.

Quantitative Lecture Experiments on Electrochemistry. By W. Lash Miller and Frank B. Kenrick. *J. Phys. Chem.*, 4, 599–618.—The authors describe in detail the construction of a lecture room galvanometer of the d'Arsonval type, and accessories, suitable for illustrating quantitatively numerous electrochemical relationships. The index of the galvanometer is so arranged that it closes a circuit through a relay, if deflected to either side of its zero position. The relay, in turn, is caused to alter a variable resistance in one arm of the Wheatstone bridge arrangement, until the adjustment for zero deflection is produced. The resistance thus automatically adjusted is recorded on a large dial, graduated to give directly in ohms the resistance of the substance measured. Fifteen quantitative lecture experiments are described, illustrating Faraday's Laws, molecular conductivity, Ostwald's dilution law, isohydric solutions, electromotive force, and polarization. (Compare also Noyes and Blanchard, *J. Am. Chem Soc.*, 22, 726.)

A New Bridge Arrangement for the Determination of Electromotive Force by Aid of the Lippmann Electrometer. By J. Livingston R. Morgan. *J. Am. Chem. Soc.*, 12, 202–204.—The arrangement consists in connecting a constant battery in series with a slide wire bridge and a resistance box containing thirteen coils each of the same resistance as the bridge wire, and balancing the unknown electromotive force against the drop in potential through a portion of the bridge coils and fraction (setting) of the bridge wire. This arrangement can hardly be designated as new.

A New Electrolytic Cell for Rectifying Alternating Currents. By W. L. Hildburgh. *J. Am. Chem. Soc.*, 22, 300–304.—This is a very neat device by which one-half the wave of an alternating current can be repressed and the current thus rectified. It consists of a large platinum electrode covered with platinum black, partly immersed in a sulphuric acid solution, and partly exposed to an atmosphere of hydrogen. The other electrode

Digitized by Google

dipping in the same solution is a small platinum-wire point sealed into a glass tube. The best size for the electrodes varies with the current. The whole cell is enclosed in an atmosphere of hydrogen. When a current passes from the large to the small electrode through the liquid, hydrogen goes into solution at the large cathode and an equal quantity is liberated at the anode. On reversing the current, the small point-electrode becomes the anode and the oxygen polarization prevents the passage of the current, provided the impressed electromotive force is not too great; in the latter case several cells are connected in series.

A Method for the Determination of Electrical Conductivity with Direct Current Instruments. By J. Livingston R. Morgan and W. L. Hildburgh. *J. Am. Chem. Soc.*, **22**, 304–307.—An alternating-current generator is connected in series with the electrolytic cell and a non-inductive resistance. Around the latter is shunted a galvanometer and a hydrogen cell for rectifying the alternating current (see preceding review). The deflection of the galvanometer is noted, and then a non-inductive resistance is substituted for the conductivity cell, and adjusted until the same deflection as before is indicated by the galvanometer. With the ordinary Kohlrausch electrolytic cell and an alternating voltage of two volts the authors state that the results agree satisfactorily with those obtained by the usual Kohlrausch method.

BIOLOGICAL CHEMISTRY.

A. G. Woodman, Reviewer.

The Proteids of the Egg Yolk. By Thomas B. Osborne and George F. Campbell. *J. Am. Chem. Soc.*, **22**, 413–422.—Salt solutions dissolve from egg yolk a mixture of protein compounds with lecithin, containing from 15 to 30 per cent. of lecithin. This lecithin is not removed by ether, but readily by alcohol. The resultant lecithin-free proteid obtained by fractional precipitation has a constant composition. The conclusion drawn is that the protein of egg yolk is principally a lecithin compound, soluble in salt solutions, and in its behavior resembling a globulin.

The Protein Constituents of Egg White. By Thomas B. Osborne and George F. Campbell. *J. Am. Chem. Soc.*, **22**, 422–450.—In a previous paper (*this Rev.*, 5, 110) Osborne described preparations of crystallized egg albumin which indicated that with the substance ordinarily known as ovalbumin there are associated other protein bodies. The authors have since repeated the work on a larger scale, confirming the earlier observations, and are able to present a number of facts concerning these and other protein substances.

Digitized by Google

The Nucleic Acid of the Embryo of Wheat and Its Protein Compounds. By THOMAS B. OSBORNE AND GEORGE F. CAMPBELL. *J. Am. Chem. Soc.*, **22**, 379–413.—The authors find that gliadin and glutenin, the principal proteid constituents of the endosperm of wheat, are not present in the embryo. The embryo does contain a nucleic acid different from any form as yet described, as well as leucosin, a globulin, and proteose. It is probable that the embryo contains a number of compounds formed by varying combinations of these protein substances with the nucleic acid.

On the Phosphorus Content of the Paranuclein from Casein. By HOLMES C. JACKSON. *Am. J. Physiol.*, 4, 170–177.—The paranuclein obtained by digestion of casein with pepsin-hydrochloric acid is shown to contain considerable amounts of phosphorus in organic combination. The results of previous investigators, who found that the phosphorus recovered in the ash of their preparations was equivalent to the total phosphorus content of the paranuclein, are attributed to the high ash content of their products. When the latter is avoided, and thus the formation of inorganic phosphates during ignition is prevented, paranuclein yields over two per cent. of organic phosphorus.

On Uric Acid Formation after Splenectomy. By LAFAYETTE B. MENDEL AND HOLMES B. JACKSON. *Am. J. Physiol.*, 4, 163–169.—The experiments of the authors indicate that the spleen is not the chief organ involved in uric acid production in the living body, and further, that it is doubtful if it plays any part whatever in this process. No diminution in uric acid production was observed in any case after splenectomy. They consider it improbable that the formation of uric acid in the mammalia can be assigned at present to any definite organ, or groups of organs.

The Occurrence and Origin of the Xanthine Bases in the Feces. By WILLIAM H. PARKER. *Am. J. Physiol.*, 4, 83–89. From experiments on a healthy man of average body-weight the general conclusion is drawn that under normal conditions on a diet containing no nucleins there is always a constant excretion of combined xanthine bases derived from the cells of the alimentary canal. This excretion is increased to nearly double the usual amount when food containing nucleins or food rich in alloxuric bodies, as meat or meat extracts, is consumed. This increase is not necessarily due directly to the ingested food, but may arise indirectly from an influence exerted on the processes of metabolism and secretion.

Digitized by Google

An Experimental Study of Oxaluria, with Special Reference to Its Fermentative Origin. By HELEN BALDWIN. *J. Expt. Medicine*, 5, 27–46.—The results of a number of experiments are given to show that in health no oxalic acid, or only a trace, is formed in the body, that present in the urine having been ingested with the food. In certain cases, however, in which free hydrochloric acid was absent from the gastric juice, it is considered that oxalic acid was formed in the organism itself, this formation being connected with fermentation in the alimentary canal.

On the Connective Tissue in Muscle. By J. H. GOODMAN. *Am. J. Physiol.*, 4, 260–263.—In a recent paper describing a new method for the determination of connective tissue in muscle, Schepilewsky (*Archiv. für Hygiene*, 34, 348) speaks of the occurrence of mucin in muscle. The author has isolated and examined this so-called mucin. No carbohydrate could be obtained from it, and it was found to contain less than 0.01 per cent. of phosphorus and an average of 16.11 per cent. of nitrogen. These results indicate that the material is neither a glycoproteid nor a nucleoproteid. It resembles more closely the "*stroma substance*" obtained by von Holmgren from horse and rabbit muscle.

On the Occurrence of Iodine in Corals. By LAFAYETTE B. MENDEL. *Am. J. Physiol.*, 4, 243–246.—The author has found considerable quantities of iodine, varying from 0.28 to 1.70 per cent., in three specimens of West Indian corals, and submits the results as additional evidence in favor of Drechsel's belief that for many organisms there is a specific iodine metabolism which is essential to the building up of the axial skeleton.

Glycogen Formation after Inulin Feeding. By R. NAKASEKO. *Am. J. Physiol.*, 4, 246–250.—The well-known experiments of Miura (*Ztschr. für Biol.*, 32, 255) have been repeated, using large portions of inulin and allowing the absorption to proceed during longer intervals than before. In only three cases was an increase of glycogen in the liver above the starvation maximum observed, showing that the glycogen-forming properties of inulin must still be regarded as uncertain or minimal.

The Influence of Acids on the Amylolytic Action of Saliva. By G. A. HANFORD. *Am. J. Physiol.*, 4, 250–260.—The author endeavors to show that contrary to the conclusions of Kubel (*Archiv. für ges. Physiol.*, 66, 276), it is impossible to point out any percentage of acid or alkali which inhibits salivary digestion in a definite degree. The character of the action is depend-

Digitized by Google

ent also upon the absolute amount of saliva and the variation in the quantity of proteid matter present. Whenever *free* hydrochloric acid is present a certain degree of inhibition is always the result.

Investigations on the Determination and Composition of Humus and Its Nitrification. By Charles Rimbach. *J. Am. Chem. Soc.*, **22**, 695–703.—The author's experiments are a direct verification of the assumption previously made, that the *matière noire* of Grandeau is a definite source of nitrates through nitrification. In studying the Grandeau method for the determination of humus, it was found that soda solution extracts more nitrogen than does ammonia, but the question still remains, which of the two is the best solvent for humus substance, by which is understood the sum of all organic substances, decomposed or not, which are immediately available as plant food.

An Experimental Study of the Gas-producing Power of Bacillus Coli Communis under Different Conditions of Environment. By Mary Engle Pennington and George C. Küsel. *J. Am. Chem. Soc.*, **22**, 556–567.—*Bacillus coli communis* has been cultivated under the most nearly concordant conditions possible, and the gas produced has been examined chemically. The results obtained show great irregularity, but in general there seems to be an intimate relation between the production of hydrogen and nitrogen. The carbon dioxide is liberated in greatest quantity at the beginning of the fermentation.

On Certain Peculiarities in the Urine of Vegetarians. By J. H. Long. *J. Am. Chem. Soc.*, **22**, 592–595.—The relation of uric acid to creatinin in normal urine is about 1 : 2; in the urines examined it was about 1 : 1.2. This is attributed to low food consumption and consequent low proteid metabolism. The observed distribution of reducing power shows that a vegetable diet, consisting largely of carbohydrates and fats, tends to increase the non-nitrogenous factors in the urine.

The Fractional Precipitation of the Globulin and Albumin of Normal Horse's Serum and Diphtheria Antitoxic Serum, and the Antitoxic Strength of the Precipitates. By James P. Atkinson. *J. Expt. Medicine*, **5**, 67–75.—The globulins of both normal and diphtheria antitoxic serum behave similarly toward chemical reagents. All of the diphtheric antitoxic power of both normal and immunized serum is always carried by the globulin and its fractional precipitates. During the fractional precipitation of the globulin some of it is lost and at the same time some of the antitoxic power of the globulin of the immunized serum is lost. These observations, together with the observed fact that

Digitized by Google

normal horse's serum contains an antitoxin which separates with the globulin, lead to the conclusion that "diphtheria antitoxin" is a form of globulin.

Adlumia Cirrhosa—A New Protopine-bearing Plant. By J. O. SCHLOTTERBECK. *Am. Chem. J.*, 24, 249–253.—The roots of this plant have been found to contain about one per cent. of an alkaloid melting at 207° (corr.). Not enough of the alkaloid was obtained to make a combustion of it, but in its crystalline form, solubility, melting-point, and principal chemical reactions it agrees exactly with the *protopine* from *Bocconia cordata* and from opium. The author further considers it probable that protopine is identical with fumarine, the alkaloid of most frequent occurrence in the *Fumariaceae*.

Assay of Drugs by the Use of Living Plants. By HENRY KRAEMER. *Am. J. Pharm.*, 72, 472–485.—From the results obtained it may be said generally that the rate of growth of certain plants in solutions containing toxic principles is inversely proportional to the toxicity of the solution. There seems to be a definite solution of alcohol or nux vomica alkaloids that is toxic, and with solutions containing different amounts of alcohol or nux vomica alkaloids there is a definite measure of growth depending upon the quantity present.

The Digestibility of Some Non-nitrogenous Constituents of Certain Feeding-stuffs. By G. S. FRAPS. *J. Am. Chem. Soc.*, 22, 543–552.—The author has determined the digestibility of certain groups of the proximate constituents of various feeding-stuffs, and finds that the probable order of digestibility is: sugars, starches, pentosans, crude fiber, residual nitrogen-free extract, and pentosans in the crude fiber. The constituents of the nitrogen-free extract, in the order of digestibility, are: sugars, starches, pentosans, and residue.

The Digestibility and Nutritive Value of Bread. By CHAS. D. WOODS AND L. H. MERRILL. *U. S. Dept. Agr., Expt. Sta. Bull.* 85, 1–51.—This bulletin is a report of progress in the extensive investigation undertaken to determine the effects of milling upon the resulting flours. The full discussion is reserved until further results are available. The work reported includes: digestion experiments with men in which bread formed the main diet; experiments upon the artificial digestion of bread with pepsin; a study of the income and outgo of nitrogen; a study of metabolic nitrogen in feces in a period with a diet of carbohydrates alone, and in a period of complete and in one of partial fasting; an investigation of the nutritive value of bread made with skim-milk as compared with that made from water; and experiments on the losses of material in baking bread.

Digitized by Google

Nutrition Investigations at the Cal. Agr. Expt. Station. By M. E. JAFFA. *U. S. Dept. Agr., Expt. Sta. Bull.* 84, 1–39.—Dietary studies have been made on a football team and on a chemist's family, and a number of dietary studies and digestion experiments have been made on infants. In one instance the metabolism of nitrogen by an infant has been studied. The studies of infants are especially interesting because of the meagerness of statistics in this line. The facts brought out show clearly the need for more study in this direction before definite conclusions can be drawn, especially with infants under one year old. The variations in the amount of protein show that there can be little comparison of the dietaries of infants under seven months old. From the seventh to the twelfth month there is more regularity, and after the first year the consumption is quite uniform.

The Wide Occurrence of Indicators in Nature. By G. S. FRAPS. *Am. Chem. J.*, 24, 271–276.—The results of the author's work show the very common occurrence of indicators in nature. Some seventy-four kinds of colored flowers and leaves were examined after extraction with water or dilute alcohol. In nearly every case the extract became one color when acid and another when alkaline. Some of the changes were very sharp, and, as a rule, the coloring-matter was fairly sensitive as an indicator, being changed by from less than 1 to 2 drops of tenth-normal ammonia.

The Nature of Commercial Sanguinarine Nitrate. By J. O. SCHLOTTERBECK. *Pharm. Rev.*, 18, 358–362.—Examination of several samples of commercial sanguinarine nitrate showed them to consist either of nearly pure chelerythrine, the methyl derivative of sanguinarine, or of a mixture of all the alkaloids of sanguinaria with more or less of its decomposition-products.

E. H. RICHARDS, REVIEWER.

Principles of Water Analysis as Applied to New Mexico Waters. By ARTHUR GOSS. *N. M. Agr. Expt. Sta., Bull.* 34, 55–106.—This bulletin gives tables of mineral contents of some 200 waters from different parts of the state, thus furuishing valuable data for future work. A case is given of the use of a water containing 440 parts of total solids per 100,000 without any inconvenience by those accustomed to it, though it was liable to cause severe illness in strangers. The usual limit of 57 parts for either potable or irrigation water cannot be adhered to in New Mexico.

G. W. ROLFE, REVIEWER.

On the Digestion and Assimilation of Pentosans and Furfuroids. By C. F. CROSS, E. J. BEVAN, AND J. S. REMINGTON.

Digitized by Google

J. Am. Chem. Soc., **22**, 630–634.—Attention is drawn to the fact that no pentosan is really known to exist, and that there is no proof that the pentoses as such are actually in the plant, the balance of evidence pointing to their formation by oxidation of hexose compounds. In fact, the authors lead us to infer that the processes employed in the separation and identification of the pentoses may possibly be the cause of their formation, a point already made by others. On this account the authors propose to define these reputed compounds identified by the furfural reaction, as *furfuroids* (furfural-gebende substances) confining the name pentosan to the theoretical "pentose-anhydride" or the pentose analogue of starch. The results of experiments with cellulose hydrolysis products fed to rabbits show that almost the whole of these "furfuroids" were digested. This is which quite contrary to the result obtained in feeding pentose sugars, are known to be practically indigestible.

Sugar Beets, 1899. By J. T. Willard and R. W. Clothier. *Bull. Kan. Sta. Agr. Col.*, **94**, 49–55. **Experiments in the Cultivation of the Sugar Beet in Nebraska.** By H. H. Nicholson and T. L. Lyon. *Bull. Neb. Agr. Expt. Sta.*, **60**, 3–34. **Sugar Beet Investigations in 1899.** By J. L. Stone and L. H. Clinton. *Bull. Cornell Univ. Agr. Expt. Sta.*, **182**, 368–385. **Sugar Beets in Sanpete and Sevier Counties.** By Luther Foster. *Bull. Utah Agr. Col. Expt. Sta.*, **63**, 3–22. **Sugar Beets and Sorghum Investigations in 1899.** By A. D. Selby. *Bull. Ohio. Agr. Expt. Sta.*, **115**, 175–192.—The titles sufficiently indicate the scope of these bulletins.

The Inversion of Cane Sugar in Various Pharmaceutical Preparations. By A. H. Waltersdorf and W. O. Richtmann. *Pharm. Arch.*, **3**, 81–94; 102–109.—The article describes an extensive investigation into the inverting effect of the ingredients of the more common syrups and elixirs on the sugar present in these preparations. The work was carried out under three temperature conditions representing the greatest, least, and average room temperatures.

ANALYTICAL CHEMISTRY.

PROXIMATE ANALYSIS.

A. G. Woodman, Reviewer.

Estimation of Fat in Condensed Milk. By Albert E. Leach. *J. Am. Chem. Soc.*, **22**, 589–591.—Twenty-five cc. of the diluted milk, corresponding to 10 grams of the original sample, are measured into a Babcock whirling-bottle. Water and

Digitized by Google

4 cc. of copper sulphate are added, and the precipitated proteids separated by the centrifuge. The supernatant solution of the sugar is withdrawn by a pipette, using a wisp of cotton over the tip as a filter, and the residue is washed twice with water, withdrawing it in each case with the pipette. Finally, enough water is added to make the volume approximately 17.6 cc., 17.5 cc. of sulphuric acid are added, and the process continued as in the ordinary Babcock method.

The Estimation of Fat in Sweetened Condensed Milk. By JOSEPH F. GEISLER. *J. Am. Chem. Soc.*, **22**, 637–645.—The author discusses critically several methods which have been proposed for the estimation of fat in condensed milk and gives results to show the considerable time that is necessary to secure complete extraction in the Adams' coil method. Where only one gram of milk is used and the extraction is continued for four or five hours, fairly satisfactory results are obtained.

The Estimation of Fat in Sweetened Condensed Milk by the Babcock Test. By E. H. FARRINGTON. *Am. Chem. J.*, **24**, 267–270.—17.6 cc. of the diluted milk is measured into a Babcock test-bottle, about 3 cc. of the usual sulphuric acid is added, and the bottle shaken vigorously. In order to compact the curd into a firm lump the bottle is whirled for about six minutes in a steam-heated turbine centrifuge, the temperature being kept at about 200° F. The sugar solution is poured off, the curd is shaken up with 10 cc. of water, 3 cc. of acid are added, and the bottles whirled as before. The sugar solution is again decanted, enough of the sugar being thus removed to prevent its interference with the regular test. The results are considered satisfactory, although the reviewer would point out that the error of multiplication, consequent upon dilution, seems greater than in some other methods proposed for the same determination.

The Detection of Coal-tar Dyes in Fruit Products. By A. L. WINTON. *J. Am. Chem. Soc.*, **22**, 582–588.—The author has found Arata's wool test (*Ztschr. anal. Chem.*, **28**, 639), most satisfactory for jellies, fruit juices, and sirups. In applying this test, 100 cc. of the liquid, prepared if necessary by boiling the substance with water, are boiled for ten minutes with 10 cc. of 10 per cent. solution of potassium bisulphate and a piece of wool, previously boiled out with dilute alkali, and washed. The wool is finally washed with boiling water and dried. The presence of certain coal-tar colors, chiefly of the azo group, may be ascertained by the dyeing of the wool.

The Adulteration and Analysis of the Arsenical Insecticides. By J. K. HAYWOOD. *J. Am. Chem. Soc.*, **22**, 568–582.—The

Digitized by Google

arsenical insecticides most generally used are Paris green, Scheele green, London purple, arsenious oxide, lead arsenate, white arsenoid, pink arsenoid, green arsenoid, and paragrene. These are adulterated in three ways: (1) By addition of some colored substance free from arsenic; (2) by addition of some inert material to increase weight; (3) by a decrease in the amount of combined arsenious oxide in the preparation. The methods for the determination of arsenious oxide in Paris and Scheele greens are compared and critically discussed.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

C. H. WARREN, REVIEWER.

A New Meteorite from Oakley, Logan County, Kansas. By H. L. PRESTON. *Am. J. Sci.*, 160, 410–412.—The meteorite, which is the eleventh one reported from Kansas, weighed 61 lbs., 10 oz., and was $7\frac{1}{2} \times 10 \times 12$ in. in its greatest diameter. It consists of "olivine and enstatite chondrules imbedded in a very irregular ground mass of the same material, with numerous particles of iron and iron sulphides." An analysis gives its composition as follows: Metallic part, Fe, 12.76 per cent.; Ni+Co, 1.68 per cent.; silicates, 85.56 per cent.; total, 100 per cent.

Silicious Calcites from the Bad Lands of South Dakota. By S. L. PENFIELD AND W. E. FORD. *Am. J. Sci.*, 160, 352–354.—The crystals are rough in appearance but show with some distinctness characteristic calcite forms. In chemical composition the crystals resemble the silicious calcites from Fontainebleau, containing about 40 per cent. of calcite and 60 per cent. of sand. The sand grains at times attain the size of small pebbles. It appears that these crystals represent a phase of sand stone formation where the calcareous cement was able to crystallize and preserve its external crystalline form.

Cambrian Silurian Limonited Ores of Pennsylvania. By T. C. HOPKINS. *Bull. Geol. Soc. Am.*, 2, 475–502.—Extensive deposits of iron ores occur as irregular pocket-like deposits in the residual clays of the Cambro-Ordovician limestones and slates of Eastern and Central Pennsylvania. The ores consist of the hydrous oxides of iron, chiefly limonite, associated with manganese ores, wavellite, quartz, chert, and fluorite. The ores appear to have been derived from the original iron content of the limestones and slates, by a leaching and concentrating process in which carbonic and organic acids, together with oxygen took part. In position the ores favor the contact of the limestone and the underlying slate.

Digitized by Google

Two New Occurrences of Corundum in North Carolina. By J. H. Pratt. *Am. J. Sci.*, 160, 295–298.—The first occurrence is in an amphibole schist, apparently a metamorphosed igneous rock of the gabbro type. The corundum is found in seams a few feet in width, and forms about 10 per cent. of the vein. The second is in a quartz schist, composed of biotite mica and quartz, in which the corundum is found along streaks or bands. It is thought that the excess of alumina contained in the original shales, which were afterwards metamorphosed into quartz schist, crystallized out along the planes of lamination.

Chemical Composition of Sulphohalite. By S. L. Penfield. *Am. J. Sci.*, 160, 425–428.—Considerable doubt as to the existence of the mineral sulphohalite, recently described and assigned the formula $3Na_2SO_4.2NaCl$, having arisen by reason of the failure of several investigators to make an artificial salt of like composition, the reinvestigation of the species described in this article was undertaken with the result that another constituent, fluorine, was discovered and the composition represented by the formula $2Na_2SO_4.NaCl.NaF$ assigned to the mineral. It is interesting to note that the sulphohalite is associated with another triple salt, the mineral hanksite, $9Na_2SO_4.2Na_2CO_3.KCl$.

Chemical Composition of Turquois. S. L. Penfield. *Am. J. Sci.*, 160, 346–350.—The article records a reinvestigation regarding the chemical composition of turquois. A new analysis was made on material exceptionally suitable for that purpose. From the results thus obtained the author shows conclusively that the mineral is to be regarded as a derivative of ortho-phosphoric acid in which the hydrogen atoms are largely replaced by the univalent, isomorphous radicals $Al(OH)^1_2$, $Fe(OH)^1_2$, and $Cu(OH)^1$. The formula may be written $[Al(OH)_2.Fe(OH)_2, Cu(OH).H]_3PO_4$. The radical $Al(OH)^1_2$ always predominates. A careful consideration of former analyses shows them to be in close agreement with the results just mentioned and wholly disprove's Clark's interpretation that turquois is a mixture of the molecule $Al_2HPO_4(OH)_4$ with finely divided iron and copper phosphates as impurities.

Scapolite Rocks from Alaska. By J. E. Spurr. *Am. J. Sci.*, 160, 310–315.—The first rock described is an andesine-oligoclase-scapolite-biotite rock of granitoid texture, occurring in the form of great dikes cutting through an older igneous rock of granite and diorite. The scapolite is considered the equivalent of a feldspar in the rock and the latter is placed parallel to the belugite group of feldspar rocks as a scapolite belugite. The name yentnite is suggested, and the type becomes a biotite yentnite. A local variation of this rock is described as microcline

Digitized by Google

scapolitic. The second rock, a light-colored dike rock cutting cretaceous shales and limestones, is described as a quartz-scapolite porphory, and is placed parallel to the quartz monzonite group of feldspar rocks. It is given the name of Kuskite. The author is of the opinion that gases—chlorine, etc.—played an important part in the formation of the scapolite; but he considers the latter to be undoubtedly an original constituent and not of secondary origin, as is probably the case with the Norwegian scapolite rocks.

Graftonite, a New Mineral from Grafton, N. H., and Its Intergrowth with Triphylite. By S. L. Penfield. *Am. J. Sci.*, 160, 20-32.—The new mineral occurs in a coarsely crystalline pegmatitic vein of quartz and feldspar. Its composition as shown by chemical analysis is represented by the formula $R''_3P_2O_8$, where R'' represents the isomorphous elements—iron, manganese, and calcium—in varying proportions. This places it in the rare group of anhydrous, normal phosphates of which triphylite is also a member. The latter occurs in thin, dark layers, distinctly interlaminated with the light-colored graftonite. Microscopical examination brings out the interesting fact that the two minerals have a definite crystallographic orientation with respect to each other. Apparently, graftonite, which constitutes something over two-thirds of the whole mass, was in sufficient quantity to give its own monoclinic symmetry to the crystals and at the same time by reason of some similarity of molecular structure, has caused the laminæ of the orthorhombic triphylite to take a definite crystallographic orientation. These relations and the crystal habit are shown by appropriate drawings.

The Action of Ammonium Chloride upon Natrolite, Scolecite, Prehnite, and Pectolite. By F. W. Clarke and George Steiger. *Am. J. Sci.*, 160, 345–351.—The present paper is one of a series having for an object the study of the chemical constitution of certain silicates. The minerals were subjected to the action of ammonium chloride in sealed tubes at a temperature of 350°, and the resulting products analyzed. The action of a boiling 25 per cent. solution of sodium carbonate was also tried on them. Both natrolite and scolecite are unattacked by the sodium carbonate solution and yield with the ammonium chloride the same compound, $(NH_4)_2Al_2Si_3O_{10}$, which is a simple replacement of the bases and acid hydrogen of the minerals by the (NH_4) radical. From these facts and an entirely new and complete analysis it is concluded that the two minerals are salts of the same silicic acid, $H_8Si_3O_{10}$, and that their formulæ should be written $Na_2Al_2Si_3O_{10}.2H_2O$ for natrolite, and $CaAl_2Si_3O_{10}.3H_2O$ for scolecite, instead of the previously accepted orthosilicate formulæ

Digitized by Google

$Al_2(CiO_4)_3Na_2H_4$ and $Al_2(SiO_4)CaH_4.H_2O$, respectively. Prehnite suffers no change when treated as above and is therefore of different structure. Pectolite, a metasilicate, $NaHCa_2Si_3O_9$, although attacked strongly by the chloride, did not yield results leading to any new or more definite conclusions as regards its structure.

Digitized by Google

Review of American Chemical Research.

INDEX OF AUTHORS.

ADAMS, M. See Richardson, G. M.
Adams, W. O. See Gill, A. H.
Alderson, M. W., cyaniding slimy ores and tailings, 52; cyaniding at Gilt Edge, Montana 53
Ashley, G. H., coal analyses 84
Atkinson, J. P., fractional precipitation of the globulin and albumin of normal horse's serum and diphtheritic serum 30, 164
Attix, J. C. See Meade, R. K.
Atwater, M. D. See Wheeler, H. L.
Atwater, W. O., and F. G. Benedict, metabolism of matter and energy in the human body 28
Atwater, W. O., and A. P. Bryant, dietary studies of university boat crews 99
Atwater, W. O., and E. B. Rosa, experiments on the conservation of energy in the human body, 28; new respiration calorimeter 105
Auchy, G., retention of moisture by asbestos, and the determination of graphite by loss, 80; determining carbon in steel 131
Austin, M., composition of the magnesium ammonium arseniate of analysis 81
Austin, R. M. See Kahlenberg, L.
Axson, E. W., nitrites as a product of combustion 26

BAILEY, L. W., mineral resources of the province of New Brunswick 83
Bain, H. F., the drifts of Northwestern Iowa 86
Baldwin, H., oxalurea and its fermentative origin 163
Bancroft, W. D., pressure-temperature diagram for binary systems, 5; dissociation studies, 5; ternary mixtures, 5; correction, 5; equilibrium of stereoisomers, 6; hydrates in solution, 9; relation of physical chemistry to technical chemistry, 71; isohydric solutions 121
Barnes, B. See Wheeler, H. L.
Barnes, H. T., molecular weight of sulphur in carbon disulphide solutions, 6; inversion of the hepta- and hexahydrates of zinc sulphate in the Clark cell, 79; the Weston cell 159
Barnett, E. A., tungsten alkyls 13
Barnett, S. J. See Merritt, E.
Bartlett, J. M. See Woods, C. D.
Baskerville, C., qualitative test for tin, 151; occurrence of vanadium, chromium, and titanium in peats 152
Bauer, F. W., silicon in ferrosilicon 82, 150
Baxter, G. P., occlusion of hydrogen by metallic cobalt and other metals, 12; See Richards, T. W.
Beatty, L. O. See Kastle, J. H.
Benedict, F. G., distillation of ammonia in the determination of nitrogen, 130; absorption apparatus for elementary organic analysis, 107; elementary analysis of organic substances containing nitrogen, 151; See Atwater, W. O.
Bentley, W. B., action of nitric acid on vanillin 140
Bevan, E. J. See Cross, C. F.
Bevier, I. See Frissell, H. B.
Beyer, S. W., geology of Story County, Iowa 84
Bigelow, S. L., simplification of Beckmann's boiling-point apparatus 107

Digitized by Google

Blasdale, W. C., Chinese vegetable food materials 26
Bogert, M. T., and A. H. Gotthelf, new synthesis in the quinazoline group 97
Bolling, R., preservation of Hübl's reagent 21
Boyle, J., new electrolytic process of manufacturing chemicals 124
Bradbury, R. H., racemism 98
Bregowsky, I. M. See Ford, A. P.
Bretherton, S. E., the Bretherton blast-heater 46
Brewer, C. E. See Orndorff, W. R.
Bridge, J. L., and W. C. Morgan, ethers of isonitrosoguiacol in their relation to the space isomerism of nitrogen 37
Browne, C. A., Jr., composition of butter-fat : the chemistry of the rancidity of butter, 24 ; chemical study of the apple and its products 100
Browning, P. E., volumetric estimation of cerium, 17 ; estimation of thallium as the acid and neutral sulphate 81
Browning, P. E., and J. B. Hartwell, qualitative separation of nickel and cobalt . . 151
Browning, P. E., and G. P. Hutchins, estimation of thallium as the chromate . . . 18
Bryant, A. P. See Atwater, W. O.
Bucher, J. E., action of ethyl iodide on tartaric ester and sodium ethylate 38
Byers, H. G. See Morse, H. N.

CADY, H. P., solid solutions 5
Calhane, D. F., and P. M. Wheeler, constitution of α-dibromdinitrobenzene 36
Cameron, F. K., estimation of alkali carbonates in presence of bicarbonates, 150 ; See Emery. J. A.; and W. H. Krug.
Camp, J. M., laboratory notes 82
Campbell, G. F. See Osborne, T. B.
Campbell, E. D., thermochemistry of iron and steel, 115 ; preparation of potassium xanthate for nickel determinations 131
Canby, R. C., potash and soda salts in lead slags, 43 ; ammonia in flue dust 43
Carney, J. A., boiler water supply of a portion of Northern Illinois 24
Carveth, H. R., composition of mixed vapors, 5 ; paraanisaldoximes 9
Chalmers. See Frazer.
Chambers, V. J., and J. C. W. Frazer, a minimum in the molecular lowering in the freezing-point of water, produced by certain acids and salts, 14 ; See Jones, H. C.
Chattaway, F. D., and K. J. P. Orton, preparation and properties of the so-called nitrogen iodide 112
Chattaway, F. D., and H. P. Stevens, action of reducing agents upon nitrogen iodide 112
Chikashigé, M. See Kuhara, M.
Chippendale, A., assay of antimony 150
Chism, R. E., new assay of mercury 60
Christensen, J. C., boiling-points of mixtures of chloral and water 157
Clark, A. J., silver plating of amalgam plates for gold mills 48
Clark, J. F., electrolytic dissociation and toxic effect 6
Clark, M. E. See Kastle, J. H.
Clarke, F. W., seventh annual report of the committee on atomic weights : results published in 1899 72
Clarke, F. W., and G. Steiger, action of ammonium chloride upon natrolite, scolecite, phrenite, and pectolite 171
Clinton, L. H. See Stone, J. L.
Clothier, R. W. See Millard, J. T.
Clymer, W. R. See Mabery, C. F.
Collins, E. See Richards, T. W.
Conn, W. T. See Michael, A.
Cook, C. G., double halides of tin with the aliphatic amines 62
Cook, E. S., blast-furnace and cupola practice 55
Cooper, A. S., effect of salt water on cement 124
Cooper, H. C., stereoisomers and racemic compounds 96

Digitized by Google

Copeland, E. B., and L. Kahlenberg, influence of the presence of pure metals upon plants 28
Cariat, I. H., phenylhydrazine test for sugar in the urine 19
Crane, F. D., contribution to the knowledge of tellurium 114
Crookes, W., the position of helium, argon, and krypton in the scheme of the elements 157
Cross, C. F., E. J. Bevan, and J. S. Remington, the digestion and assimilation of pentosans and furfuroids 166
Curtiss, R. S., action of nitrous acid on ethyl anilidomalonate 137

DAINS, F. B., action of certain acid reagents on the substituted ureas 98
Darbon, M. A., manufacture of sodium nitrite 23
Davis, D. J. See Kahlenberg, L.
Davis, G. C., malleable iron industry 57
Dawson, H. M., and P. Williams, determination of transition temperatures 146
De Barr, E., rate of action of water on certain α-, β-, and γ-halogen substituted acids 33
Dennis, L. M., and C. G. Hopkins, determination of carbon monoxide, methane, and hydrogen by combustion 21
Divine, R. E., determination of carbon dioxide in carbonates 149
Dohme, A. R. L., history of the constitution of the alkaloids 98
Doolittle, R. E. See Hess, W. H.
Doolittle, R. E., and W. H. Hess, cider vinegar, its solids and ash 101
Dudley, C. B. See Noyes, W. A.
Duff, W. A. See Morgan, J. L.
Dugan, C., esters of tungstic acid 13
Duhem, P., dissociation pressure before H. Sainte-Claire Deville, 8; emission and absorption of water vapor by colloidal matter 74, 157
Dunnington, F. P., and T. Hoggard, thermal effects of the dilution of some salts . 74

EDGERLY, D. W. See Norris, J. F.
Elbers, A. D., manufacture of sulphur-free mineral wool, 54; utilization of blast-furnace slag 55
Elms, J. W. See Parmelee, C. L.
Emery, A. L., source of error in soil analysis 129
Emery, J. A., and F. K. Cameron, freezing-point curve for water containing hydrochloric acid and phenol 74
Evans, T., ricinine 40

FACKENTHAL, B. F., tuyeres in the iron blast-furnace 53
Farrington, E. H., estimation of fat in sweetened condensed milk 168
Fay, H. See Norris, J. F.
Fernberger, H. M., and E. F. Smith, electrolysis of metallic phosphate solutions . . 13
Firmstone, F., forms assumed by the charge in the blast-furnace 54
Fischer, R. See McPherson, W.
Fleck, H., action of sulphur monochloride upon tungsten trioxide 13
Foote, W. M., new meteoric iron found near Iredell, Tex 68
Ford, A. P., and I. M. Bregowsky, determination of graphitic carbon in cast and pig iron 17
Foster, L., sugar beets 167
Foster, W., Jr., hydrolysis of stannic chloride, 3; conductivity and dissociation of some electrolytes 76
Fowler, R. E. See Kahlenberg, L.
Franklin E. C., and C. A. Kraus, conductivity coefficients of some liquid ammonia solutions 158
Fraps, G. S., supposed isomeric potassium sodium sulphites, 109; the digestibility of some non-nitrogenous constituents of certain feeding stuffs, 165; the wide occurrence of indicators in nature 166
Frazer and Chalmers, a clean-up trolley for gold mills, 119; hydraulic amalgam squeezer 119

Digitized by Google

Frazer, J. C. W. See Chambers, V. J.
Frazer, P., the Kytchtym medal 55
Frear, W., and W. A. Hutchinson, winter vs. spring bran 100
Freer, P. C., action of benzoyl chloride on the phenylhydrazones of benzoin 35
Frissell, H. B., and I. Bevier, dietary studies of negroes 99
Fuller, R. W. See Jackson, C. L.

GAZZOLO, F. H. See Jackson, C. L.
Geisler, J. F., estimation of fat in sweetened condensed milk 168
Gill, A. H., and W. O. Adams, Hübl's iodine method for oil analysis 103
Goldberg, A., estimation of bisulphide of carbon 105
Gomberg, M., diazocaffeine 37
Gooch, F. A., and F. H. Morley, iodometric determination of gold 17
Gooch, F. A.. and J. C. Morris, iodometric estimation of arsenic acid 151
Goodman, J. H., connective tissue in muscle 163
Gordin, H. M., estimation of salt-forming alkaloids 18
Gordin, H. M., and A. B. Prescott, directions for certain alkaloidal assays, 18; estimation of alkaloids, 18; hydrastine hexaiodide, and the assay of *hydrastis canadensis* 22
Goss, A., principles of water analysis as applied to New Mexico waters 166
Gotthelf, A. H. See Bogert, M. T.
Grainger, W. E., electrolytic determination of copper 150
Gregory, H. E., andesites of the Aroostook volcanic area of Maine 67
Gressman, G. W., electrical resistance of lead amalgams at low temperatures . . . 3
Griffin, M. L., removing lime and magnesia from natural waters 23
Guess, H. A., gluten constituents of wheat and flour 128

HALL, C., tungsten alkyls 13
Hall, E. H., relation between pressure and evaporation 8
Hall, F. H. See Jordan, W. H.
Handy, J. O., volumetric determination of magnesia 80
Hanford, G. A., influence of acids on the amylolytic action of saliva 163
Hardin, W. L., derivatives and atomic mass of palladium, 4; atomic mass of tungsten 13
Hardy, W. B., the conditions which determine the stability of irreversible hydrosols, 144; mechanism of gelatine in reversible colloidal systems 145
Hartman, J. M., tuyeres in the iron blast-furnace 53
Hartshorne, J., notes on the Bertrand-Thiel process 58
Hartwell, B. L. See Wheeler, H. J.
Hartwell, J. B. See Browning, P. E.
Hayes, C. W., physiography and geology of the Nicaraugua Canal route 86
Haywood, J. K., some boiling-point curves, 7; determination of glycogen in the flesh of a horse, 102; adulteration of analysis of arsenical insecticides . . . 149, 168
Haywood, W. G., certain double chromates 153
Hawk, P. B. See Sherman, H. C.
Hedden, W. E. See Judd, J. W.
Heimrod, G. W. See Richards, T. W.
Henderson, G. R., manufacture of car wheels 57
Hershey, O. H., gold-bearing formation of Stephenson Co., Ill., 87; origin and age of certain gold pocket deposits in California 86
Herter, C. A., and A. J. Wakemann, action of hepatic, renal, and other cells on phenol and indol 27
Hess, W. H., rapid gravimetric estimation of lime, 149; See Doolittle, R. E.
Hess, W. H., and R. E. Doolittle, methods for the detection of "process" and "renovated" butter 102
Higbee, H. H., double halides of antimony with aniline and the toluidines 65
Hildburgh, W. L., new electrolytic cell for rectifying alternating currents, 160; See Morgan, J. L.
Hill, H. B., C. A. Soch, and G. Oenslager, nitromalonic aldehyde 137

Digitized by Google

Hillebrand, W. F. See Noyes, W. A.
Hillyer, H. W., action of picryl chloride on pyrocatechin in presence of alkalies . . 39
Hinds, J. I. D., lime and sulphuric acid by the photometric method 131
Hite, B. H., method for carrying out chemical reactions under high pressures . . . 108
Hofman, H. O., modification of Bischof's method for determining the fusibility of clay 41
Hofman, H. O., and B. Stoughton, does the size of particles bear any influence in determining the resistance of fire clays to heat and fluxes? 41
Hoggard, T. See Dunnington, F. P.
Hollis, F. S., symmetrical chloride of *p*-nitro-*o*-sulphobenzoic acid 96
Hopkins, C. G. See Dennis, L. M.
Hopkins, E., sod oil, wool grease, and degras 127
Hopkins, T. C., cambrian silurian limonited ores of Pennsylvania 169
Howe, H. M., use of the triaxial diagram and triangular pyramid for graphical illustration, 53; explanation of the rapidity of the Bertrand-Thiel process . 58
Howe, J. L., the eighth group of the periodic system and some of its problems . . . 148
Howe, J. L., and J. L. Morrison, action of a hard water on certain metals 22
Hubbard, G. D., Blue Mound quartzite 87
Hummel, J. A., examination of Brown and Taylor's official method of identifying butter 129
Hurty, J. N., tannin determinations 21
Hutchinson, W. A. See Frear, W.

ILES, M. W., silver losses in smelting, 42; lead smelting and gold and silver refining: slag settling furnaces, 42; refining products, 43; a liquid from the fume of lead furnaces, 43; fans for handling lead fume, 43; cost of smelting silver lead ores, 117; apparatus for collecting solids from smoke 118
Iles, M. W., and C. F. Shelby, potash and soda salts from natural decomposition of lead slags 42
Ingall, E. D., annual report for section of mineral statistics and mines 83

JACKSON, C. L., and R. W. Fuller, constitution of di-*p*-brombenzylcyanamide . . 136
Jackson, C. L., and F. H. Gazzolo, certain colored substances derived from nitro-compounds 133
Jackson, D. D. See Whipple, G. C.
Jackson, H. B. See Mendel, L. B.
Jackson, H. C., phosphorus content of the paranuclein from casein, 162; See Mendel, L. B.
Jaffa, M. E., nutrition investigations at the Cal. Agr. Exp. Sta 166
Job, R., causes of hot boxes in railway service 125
Johnson, T. B. See Wheeler, H. L.
Jones, H. C., and V. J. Chambers, some abnormal freezing-point lowerings produced by chlorides and bromides of the alkaline earths 72
Jones, H. C., and N. Knight, on aqueous solutions of double salts 1
Jones, H. C., and K. Ota, on aqueous solutions of double salts 1
Jones, H. C., and A. W. Smith, solution-tension of zinc in ethyl alcohol 158
Jones, W., oxygen in the cyanide process, 119; Blakemore's results in refining lead by Parke's process 43
Jones, W. A., dicarbonyl cuprous chloride 12
Jordan, W. H., and F. H. Hall, digestibility of American feeding-stuffs 128
Judd, J. W., W. E. Hidden, and J. H. Pratt, new mode of occurrence of ruby in N. C. 67

KAHLENBERG, L., difference of potential between metals and non-aqueous solutions of their salts, 11; preparation of metallic lithium, 111; relation of the taste of acid salts to their degree of dissociation, 73, 147; electrolytic deposition of metals from non-aqueous solutions, 158; See Copeland, E. B.
Kahlenberg, L., and R. M. Austin, toxic action of acid sodium salts on *Lupinus Albus* 157
Kahlenberg, L., and D. J. Davis, and R. E. Fowler, inversion of sugar by salts . . . 4

Digitized by Google

Kastle, J. H., the effect of low temperatures on the color of the compounds of chlorine and bromine 153
Kastle, J. H., and L. O. Beatty, the supposed allotropism of phosphorus pentabromide 153
Kastle, J. H., and M. E. Clark, effect of various solvents on the allotropic change of mercuric iodide 62
Kebler, L. F., gold sodium chloride 154
Keller, E., elimination of impurities from copper matte in the reverberatory and the converter, 47; notes on selenium and tellurium 116, 122
Kenrick, F. B. See Miller, W. L.
Kinnicutt, L. P., and G. R. Sanford, iodometric determination of small quantities of carbon monoxide 80
Kleber, C., analysis of essential oils 104
Kloz, L., furnace for smelting zincose lead ores 42
Knight, N. See Jones, H. C.
Koenig, G. A., scorification and cupellation without muffle 59
Kollock, L. G., electrolytic determinations and separations 15
Kortright, F. L., deliquescence of potassium nitrate, sodium nitrate, and ammonium nitrate 7
Kraus, C. H. See Franklin, E. C.
Kreider, D. A. See Wright, A. W.
Kremers, E. See Schreiner, O.
Kremers, H., assays of drugs by the use of living plants 165
Krug, W. H., and F. K. Cameron, on the system water, phenol, and hydrochloric acid 120
Kuhara, M., and M. Chikashigé, method for the determination of the melting-point, 107; formation of indigo from diphenyldiketopiperazine 140
Küsel, G. C. See Pennington, M. E.

LACHMAN, A., preparation of zinc ethyl 138
Ladd, G. F., the cretaceous and associated clays of middle Georgia 86
Lamar, W. R., assay of opium 19
Lang, H., utilizing the heat of molten slag 117
Langmuir, A. C., determination of sulphur in bitumens, 80; determination of nickel in nickel ores 81
Lane, A. C., coal in lower Mich., 85; magmatic differentiation in the rocks of the copper-bearing series 85
Leach, A. E., character and extent of food and drug adulteration in Mass., 99; foreign coloring-matter in milk, 101; estimation of fat in condensed milk . . 167
Leffmann, H., engineering chemistry of boiler waters 24
Lenher, V., some new tellurium compounds 115
Lenher, V., and H. A. Loos, decomposition of nickel carbonyl in solution 66
Lenher, V., and J. L. Morgan, specific gravity and electrical resistance of metallic tellurium 79
Levene, P. A., chemistry of mucin 98
Lewis, G. N., the development and application of a general equation for free energy and physico-chemical equilibrium 1
Lincoln, A. T., electrical conductivity of non-aqueous solutions, 10; physical reaction and the mass law 120
Lindgren, W., granodiorite and other intermediate rocks 83
Linebarger, C. E., surface-tensions of mixtures of sulphuric acid and water and the molecular mass of sulphuric acid 71
Linton, R., glass-making in the United States 22
Lodge, R. W., assaying telluride ore for gold 60
Long, J. H., peculiarities in the urine of vegetarians, 164; relation of the reducing power of normal urine to the amount of certain nitrogen compounds present 129
Longstaff, J. P., ammonium molybdate as a test for tin 149
Loomis, E. H., freezing-point of aqueous solutions of non-electrolytes 142

Digitized by Google

Loos, H. A. See Lenher, V.
Loring, W. J., mill practice of the Utica Mills, Cal 51
Low, A. H., technical estimation of zinc 122
Lusk, G. See Ray, W. E.; and Parker, W. H.
Lyon, T. L. See Nicholson, H. H.
Lyons, A. B., assay process for fluid extracts 19

MABERY, C. F., and W. R. Clymer, determination of carbon and hydrogen by combustion in oxygen, using copper oxide 130
MacGregor, J. G., applicability of the dissociation theory to the electrolysis of aqueous solutions containing two electrolytes with a common ion 76
Mackay, P. A., analysis of zinc for cadmium and lead 16
Magie, W. F., specific heat of solutions which are not electrolytes 11
Mahon, R. W., determination of chromium in steel 16
Mar, A. D., pneumatic cyanide process 53
Mathews, A., origin of fibrinogen 29
Mathews, J. A., laboratory method for the generation of acetylene, 107; bismuth cobalticyanide, 116; See Miller, E. H.
Mathews, J. A., and L. L. Watters, carbide of gold 65
McCoy, H. N., apparatus for determining molecular weights by the boiling-point method 108
McDermott, T. S. See Ray, W. E.
McIlhiney, P. C., determination of the bromine absorption of oils 103
McPherson, W., nature of the oxyazo compounds 34
McPherson, W., and R. Fischer, action of α-acylated phenylhydrazines on the chlorine derivatives of quinone 97
Meade, R. K., determination of zinc by the use of standard thiosulphate solutions 131
Meade, R. K., and J. C. Attix, determination of volatile combustible matter in coke and anthracite coal 103
Mendel, L. B., occurrence of iodine in corals 163
Mendel, L. B., and H. C. Jackson, excretion of kynurenic acid, 29; uric acid formation after splenectomy 162
Merrill, G. P., the use of the terms rock weathering, serpentinization, and hydrometamorphism 87
Merrill, J. F., influence of temperature, pressure, used solutions, and size of anodes on the deposit of silver voltameters 7
Merritt, E., and S. J. Barnett, influence of electrification upon the surface-tension of water and mercury 78
Michael, A., and W. T. Conn., chlorine heptoxide 114
Miller, E. H., and J. A. Mathews, preliminary study of the cobalticyanides 65
Miller, F. W. Se Venable, F. P.
Miller, W. G., corundum-bearing rocks of Eastern Ontario 87
Miller, W. L., and F. B. Kenrick, chemical experiments; reversible chemical reactions, 141; quantitative lecture experiments on electrochemistry 160
Mitchell, A. S., lemon-flavoring extract and its substitute 19
Mixter, W. G., hypothesis to explain the partial non-explosive combination of explosive gases and gaseous mixtures, 75; products of the explosion of acetylene 91
Mommers, R. See Norris, J. F.
Moore, B. E., polarization and internal resistance of copper voltameter 78
Moore, M. J., determination of sulphur in pig iron 16
Morgan, J. L. R., electrolytic deposition of brass, 79; three additions to the Kohlrausch-Ostwald conductivity method, 109; new interrupter for the Kohlrausch-Ostwald conductivity method, 109; new bridge arrangement for the determination of electromotive force, 160; See Lenher, V.
Morgan, J. L. R., and W. A. Duff, a chromium cell for the rectification of alternating currents 159

Digitized by Google

Morgan, J. L. R., and W. L. Hildburgh, determination of electrical conductivity with direct current instruments 161
Morgan, W. C., space isomerism of the toluquinoneoxime ethers, 36; See Bridge, J. L.
Morley, E. W., are further experiments needed for the atomic weight of oxygen? . 70
Morley, F. H. See Gooch, F. A.
Morris, J. C. See Gooch, F. A.
Morrison, J. L. See Howe, J. L.
Morse, H. N., and H. G. Byers, cause of the evolution of oxygen when oxidizable gases are absorbed by permanganic acid 112
Morse, H. N., and J. C. Olsen, permanganic acid by electrolysis 113
Morton, D. A. See Orndorff, W. R.
Mosnat, H. R., artesian wells of the Belle Plaine area, Iowa 84

NAGEL, I., rancidity of fats 104
Nakaseko, R., glycogen formation after inulin feeding 163
Neilson, T., roasting copper ores 45
Nichols, E. L., coefficient of expansion of ice 10
Nicholson, H. H., and T. L. Lyon, the sugar beet in Nebraska 167
Norris, J. F., H. Fay, and D. W. Edgerly, preparation of pure tellurium 63
Norris, J. F., and H. Fay, reduction of selenium dioxide by sodium thiosulphate . . 64
Norris, J. F., and R. Mommers, isomorphism of selenium and tellurium 152
Norton, W. H., geology of Scott County, Iowa 84
Noyes, W. A., camphoric acid 92
Noyes, W. A., W. F. Hillebrand, and C. B. Dudley, report of committee on coal analysis 81

OENSLAGER, G. See Hill, H. B.
Olsen, J. C. See Morse, H. N.
Orndorff, W. R., and C. E. Brewer, constitution of gallein and coerulein 134
Orndorff, W. R., and D. A. Morton, anethol and its isomers 94
Orndorff, W. R., and F. A. Richmond, phenyl mustard oil as a reagent for the detection of the alcoholic hydroxyl group 37
Orton, K. J. P. See Chattaway, F. D.
Osborne, T. B., and G. F. Campbell, proteids of the egg yolk, 161; protein constituents of egg-white, 161; nucleic acid of the embryo wheat 162
Ota, K. See Jones, H. C.

PARKER, W. H., occurrence and origin of xanthine bases in the feces 162
Parker, W. H., and G. Lusk, maximum production of hippuric acid in rabbits . . . 98
Parmelee, C. L., and J. W. Ellms, estimation of the weight of suspended matter in water 20
Pease, H. C., electrochemical equivalent of carbon 79
Peckham, S. F., what is parianite? 124
Penfield, S. L., graftonite, 68; chemical composition of sulphohalite, 170; chemical composition of turquois, 170; graftonite, a new mineral, and its intergrowth with triphylite 171
Penfield, S. L., and W. E. Ford, silicious calcites from the bad lands of S. D 169
Penfield, S. L., and C. H. Warren, new minerals from the zinc mines at Franklin, N. J., and the chemical composition of ganomalite 66
Pennington, M. E., and G. C. Küsel, the gas-producing power of *bacillus coli communis* 164
Peters, C. A., separation and determination of mercury as mercurous oxalate . . . 150
Peters, S., improvements in the manufacture of bar iron 57
Pettit, J. H., minimum boiling-points and vapor compositions 8
Phillips, A., the Jackson system of treating ores 84
Pilhashy, B. M., comparison of some formaldehyde tests 97, 102
Powell, N. S. See Richards, J. W.
Pratt, J. H., new occurrence of corundum in N. C., 170; See Judd, J. W.

Digitized by Google

Preston, H. L., Illinois gulch meteorite, 83; two new American meteorites, 84; new meteorite from Oakley, Kas 169
Prescott, A. B. See Gordin, H. M.

RAGLAND, C. D., double halides of cadmium with the the methylamines 61
Ransom, J. H., molecular rearrangement of *o*-aminophenylethyl carbonate to *o*-oxyphenylurethane 85
Ransome, F. L., new occurrence of nepheline syenite in N. J 68
Ray, W. E., T. S. McDermott, and G. Lusk, metabolism during a combination of phosphorus poisoning and phlorhizin diabetes 30
Reid, E. E., valuation of saccharin 21
Remington, J. S. See Cross, C. F.
Richards, F. B., slips and explosions in the blast-furnace 54
Richards, J., testing lead-tin and lead-antimony alloys 42
Richards, J. W., recent progress in the aluminium industry 125
Richards, J. W., and N. S. Powell, substitutes for hydrochloric acid in testing carbonates 81
Richards, T. A., alluvial deposits of western Australia 48
Richards, T. W., method of standardizing weights, 106; relation of the taste of acids to their degree of dissociation, 121; determination of sulphuric acid in the presence of iron; a note on solid solutions, 143; the driving tendency of physico-chemical reactions and its temperature coefficient, 143; table of atomic weights of seventy-four elements 144
Richards, T. W., and G. P. Baxter, revision of the atomic weight of cobalt: analysis of cobaltous chloride and oxide, 69; revision of the atomic weight of iron . 143
Richards, T. W., E. Collins, and G. W. Heimrod, electrochemical equivalents of copper and silver 76
Richardson, G. M., and M. Adams, double halides of tin with organic bases 62
Richmond, F. A. See Orndorff, W. R.
Richtmann, W. O. See Waltersdorf, A. H.
Ries, H., ultimate and rational analysis of clays 40
Reinhoch, C., determination and composition of humus and its nitrification 164
Riter, G. W., water required for stamp milling 48
Roberts, G. M., sampling silver-lead bullion 58
Rogers, A., test for tin 130
Rosa, E. B., metabolism of matter in the living body, 99; See Atwater, W. O.
Ross, B. B., fertilizer resources and industry in Ala 123
Rothwell, R. P., Calkins cupel machines 59
Runge, C., spectra of krypton 12
Ryland, G., study of liquid mixtures of constant boiling-point 75

SANFORD, G. R. See Kinnicutt, L. P.
Sargent, C. L. See Wheeler, H. J.
Sargent, G. W., determination of nickel in nickel-steel, 15; quantitative estimation of boric acid in tourmaline, 15; the repeated use of the double chloride of copper and potassium for the solution of steel or iron in estimating copper, 122; rapid method for the determination of carbon in iron and steel 131
Sarles, E. H., color of chlorine solutions 14
Saunders, A. P., allotropic forms of selenium 147
Saurel, P., Maxwell's theorem, 5; demonstration of the phase rule, 5; stability of equilibrium of a one-component system, 8; two theorems of Gibbs 121
Scheer, E. W., reducing roasting 45
Schlotterbeck, J. O., *adlumia cirrhosa*—a new protopine-bearing plant, 165; value of commercial sanguinarine nitrate 166
Schreiner, O., and E. Kremers, nitroso derivatives of caryophyllene and cadinene . 39
Schreiners, O., column for illustrating the principle of fractional distillation and of dephlegmators 108
Selby, E. D., sugar beets and sorghum investigations 167

Digitized by Google

Shaler, N. S., formation of dikes and reins 85
Shaw, G. W., Oregon prune, 101 ; analysis of strawberries 128
Shelby, C. F. See Iles, M. W.
Shengle, J. C., and E. F. Smith, precipitation of copper by zinc 16
Sherman, H. C., and P. B. Hawk, estimation of nitrogen, sulphates, and phosphates after the ingestion of proteid food 127
Shimer, P. W., simplified reductor 106
Slosson, E. E., chemical analysis of Wyoming petroleum 24
Smith, A. W. See Jones, H. C.
Smith, E. F., observations upon tungsten, 13 ; See Fernberger, H. M.; and Shengle, J. C.
Smith, F. D., Montana and Denver Reduction Co's mill at Bearmouth 119
Smith, F. W., analysis of dynamite 20
Smith, T., relation of dextrose to the production of toxin in cultures of the diphtheria bacillus 27
Snyder, H., soil investigations, 100; proteids of wheat flour 100
Snyder, H., and L. A. Voorhees, studies on bread and bread-making 26
Soch, C. A. See Hill, H. B.
Sperry, E. S., new form of mould for casting brass ingots, 44; influence of antimony on the cold-shortness of brass 44
Speyers, C. L., molecular weights of liquids, 3 ; Van't Hoff's equation and the molecular weight of liquids 4
Spurr, J. E., scapalite rocks from Alaska 170
Squibb, E. R., use of acetic acid in extracting drugs, 19 ; acetic acid as a substitute for alcohol in drug extraction 129
Steiger, G. See Clarke, F. W.
Steinhart, O. J., silicon and copper silicide 44
Stevens, H. P. See Chattaway, F. D.
Stieglitz, J., lecture experiments to illustrate equilibrium and dissociation 141
Stone, J. L., and L. H. Clinton, sugar beet investigations 167
Stoughton, B. See Hofman, W. O.
Summers, B. S., cupola practice and the physics of cast-iron 56
Sweetster, R. H., analysis of blast-furnace gas, while blowing in 54

TAYLOR, ——, portable stamp-mill 118
Taylor, A. E., origin of fat from protein in the so-called fatty metamorphosis of phosphorous poisoning, 27 ; modified Soxhlet apparatus for the extraction of fat from liquids, 108 ; vapor-pressure relations in mixtures of two liquids 146
Thatcher, R. W., feeding value of sorghum as shown by chemical analysis 100
Thiele, F. C., Texas petroleum 127
Thomas, G. E., apparatus for the analysis of illuminating and fuel gases 106
Tingle, A., reactions of aniline and hydroxylamine with hydroxy- and unsaturated compounds, 138 ; influence of substituents on the electrical conductivity of benzoic acid 10
Tingle, J. B., and A. Tingle, condensation compounds of amines and camphoroxalic acid 94
Tower, O. F., the precipitation of the sulphides of nickel and cobalt in an alkaline tartrate solution, and the nature of certain tartrates of these metals 155
Trevor, J. E., electromotive forces of concentration cells, 5 ; notes on the energy theory, 8 ; thermal coefficients, 9 ; thermal and dynamic coefficients, 74 ; entropy and heat capacity, 147 ; relationships between thermodynamic fundamental functions 157
Trowbridge, C. C., specific heat of metals at low temperatures 9
Trubek, M., technical analysis of licorice paste 102
Twitchell, E., benzenestearosulphonic acid 40

ULKE, T., rapid method for the determination of lime in blast-furnace slags . 82

VEITCH, F. P., direct determination of available phosphoric acid, 16 ; determination of nitrogen in fertilizers containing nitrates, 17 ; estimation of alumina and ferric oxide in natural phosphates 130

Digitized by Google

Venable, F. P., nature of the change from violet to green in solutions of chromium salts 71
Venable, F. P., and F. W. Miller, nature of the change from violet to green in solutions of chromium salts 70
Voege, A. L., electrolytic reduction of potassium chlorate 78
Voorhees, L. A. See Snyder, H.

WADDELL, J., conversion of ammonium thiocyanate into thiourea, 4; reversible reactions, 5; freezing-point in ternary mixtures 6
Wade, E. M., and M. L. Wade, qualitative test for boracic acid 150
Wade, M. L. See Wade, E. M.
Wakeman, A. J. See Herter, C. A.
Waltersdorf, A. H., and W. O. Richtmann, inversion of cane-sugar in various pharmaceutical preparations 167
Warren, C. H. See Penfield, S. L.
Warren, H. L. J., De La Mar's mercur mines 50
Warwick, A. W., water and fuel economy in stamp milling 118
Washington, H. S., analyses of Italian volcanic rocks 82
Watson, T. L., weathering of diabase in Virginia 87
Watters, L. L. See Mathews, J. A.
Webb, J., pneumatic cyanide process 53
Weber, H. A., testing soils for application of commercial fertilizers 26
Webster, W. R., relation between the chemical constitution and the physical character of steel 58
Wheeler, E. C., basic furnace for malleable iron 57
Wheeler, H. J., B. L. Hartwell, and C. L. Sargent, chemical methods for ascertaining the lime requirement of oils, 103; the amount of humus in soils and the percentage of nitrogen in humus 25
Wheeler, H. L., sodium salts of the amides 135
Wheeler, H. L., and B. Barnes, molecular rearrangement of the thioncarbamic, thioncarbanilic, and thioncarbazinic esters 138
Wheeler, H. L., T. B. Johnson, M. D. Atwater, and B. Barnes, rearrangement of imido esters 92
Wheeler, P. M. See Calhane, D. F.
Whipple, G. C., and D. D. Jackson, silica standards for the determination of turbidity in waters, 20; asterionella, 24; normal chlorine map of Long Island . . 128
Whitehead, C., proof gold and silver 59
Whitney, W. R., nature of the change from violet to green in solutions of chromium salts 70
Willard, J. T., and R. W. Clothier, sugar beets, 1899 167
Williams, P. See Dawson, H. M.
Winchell, H. V., Minnesota iron mining 84
Winton, A. L., detection of coal-tar dyes in fruit products 168
Wolf, C. G. L., melting-point of chloral hydrate, 72; melting-point of formylphenyl acetic ester, 74; electrolysis of sodium chloride 159
Woodman, J. E., ore-bearing schists of Cape Breton 85
Woods, C. D., and J. M. Bartlett, experiments with potatoes 101
Woods, C. D., and L. H. Merrill, digestibility and nutritive value of bread 165
Wright, A. W., and D. A. Kreider, the relation between structure and magneto-optic rotation 156

ZELLWEGER, J., Zellweger roasting kiln 116

Digitized by Google

INDEX OF SUBJECTS.

ACETIC acid, use in drug analysis . . . 19, 129
Acids: relation of dissociation, to taste, 121; influence on action of saliva, 163; fatty, halogen derivatives, action of water on . . . 33
Acetoacetic ester, sodium derivative, action on nitro compounds . . . 133
Acetone: aqueous solutions, vapor pressure, 146; freezing-point . . . 142
Acetylene: products of the explosion, 91; apparatus for generating and purifying, 107; preparation of alcohol from . . . 124
Adlumia cirrhosa . . . 165
Albumen, in horse's serum . . . 30
Alcohol, preparation, from acetylene . . . 124
Alcohols: compounds, with phenyl mustard oil, 37; freezing-point of aqueous solutions . . . 142
Alkaloids: assay, 18, 19; history of constitution . . . 98
Alumina: determination as phosphate, 82; determination in phosphates . . . 130
Aluminum: action of hard water on, 22; allows, 125; electrolytic separation from copper, 13; industry, 125: specific heat, 9; chloride, conductivity in organic solvents . . . 10
Amalgam squeezer . . . 119
Amalgams: electromotive force between, 5; lead, electrical resistance . . . 3
Amides, rate of formation of sodium salts . . . 135
Amines: double halides with tin, 62; double halides with tellurium . . . 115
o-Aminophenylethylcarbonate, rearrangement . . . 89
Ammonia: presence in flue dust, 43; liquid, solutions, conductivity coefficients . 158
Ammonium: chloride, action on certain minerals, 171; nitrate, solutions, specific gravity and conductivity, 76; nitrate, deliquescence, 7; thiocyanate, conversion into thiourea, 4; salts, conductivity of solutions in liquid ammonia 158
Analysis: organic, of substances containing nitrogen, 151; absorption apparrtus for . . . 107
Andesites . . . 67
Anethol . . . 94
Aniline: action on ethyl tartrate, 138; double halides with tin, 62; double halides with tellurium, 115: double halides with antimony . . . 65
p-Anisaldoximes . . . 9
Antimony: assay, 150; effect on brass, 44; alloys with lead, testing, 42; double halides with organic bases, 65; chloride, conductivity in organic solvents . . 10
Apparatus: extraction, 108; for determining molecular weights, 107, 108; for determining conductivity . . . 109
Apple, chemical composition . . . 100
Argon, position in the scheme of the elements . . . 157
Arsenic: determination in insecticides, 169; reducing roasting, 45; acid, iodometric determination . . . 151
Asbestos, retention of water by . . . 80
Asphalt, nature of . . . 125
Asterionella, effect on water supply . . . 24
Atomic weight: cobalt, 69; copper, 77; iron, 143; oxygen, 70; palladium, 4; tungsten . . . 13
Atomic weights: report of committee on, 72; table . . . 144

BACILLUS, diphtheria, production of toxin in . . . 27
Bacillus coli communis, gas-producing power . . . 164
Barium chloride solutions, abnormal freezing-point . . . 72
Bearings, railway . . . 125

Digitized by Google

Beets, sugar, investigations . . . 167
Benzenestearosulphonic acid . . . 40
Benzoic acids, substituted, conductivity . . . 10
Benzoin, phenylhydrazones, action of benzoyl chloride on . . . 35
Benzoyl chloride, action on phenylhydrazones of benzoin . . . 35
Benzoyloxyphenylurethane . . . 90
Berberine, estimation . . . 22
Bertrand-Thiel process . . . 58
Bismuth: effect on brass, 44; chloride, conductivity, dissolved in organic solvents, 10; cobalticyanide . . . 65, 116
Bitumens, determination of sulphur in . . . 80
Blast-furnace: explosions, 54; feeding, 54; practice, 55; gas, analysis . . . 54
Blast-heater . . . 46
Bleaching, by means of sodium bisulphite . . . 126
Boiling-point: apparatus, 107, 108; curves, 7; constant, of liquid mixtures . . . 75
Boiling-points of mixtures . . . 8
Boracic acid, qualitative test for . . . 150
Boric acid, estimation . . . 15
Bran, analyses . . . 100
Brass: action of hard waters on, 22; effect of antimony on, 44; effect of bismuth on, 44; electrolytic deposition . . . 79
Bread, digestibility and nutritive value . . . 165
Bread-making, chemistry . . . 26
Bromides, effect of low temperature on color of . . . 153
Bromine, absorption by oils . . . 103
Brombutyric acid, action of water on . . . 33
Brompropionic acids, action of water on . . . 33
Bromtoluquinone-*o*-oxime, benzoyl ether . . . 36
Butter: identification, 129; "renovated" detection . . . 102
Butter-fat: chemical composition, 25; chemistry of rancidity . . . 25

CADINENE, nitroso derivatives . . . 39
Cadmium: estimation in zinc, 16; cobalticyanide, 65; double halides with organic bases . . . 61
Caffeine, diazo derivative . . . 38
Calcites, silicious . . . 169
Calcium: determination, 149; chloride solutions, abnormal freezing-point, 72; oxide, determination in slags, 82; oxide, determination photometrically . 131
Calorimeter, respiration . . . 105
Camphoric acid . . . 92
Camphoroxalic acid, condensation products with amines . . . 94
Carbon: electrochemical equivalent, 79; determination in steel, 122, 131; determination by combustion, 130, graphitic, influence on cast-iron, 56; graphitic, estimation in iron, 7; bisulphide, determination, 105; dioxide, determination, 149; monoxide, determination, 21, 80, 149; monoxide compound with cuprous chloride . . . 12
Carbonates: testing for, in the field, 81; estimation in the presence of bi-carbonates . . . 150
Caryophyllene, nitroso derivatives . . . 39
Cell: chromium for the rectification of alternating currents, 159; Clark, inversion by hydrates of zinc sulphate in, 79; electrolytic for rectifying alternating currents, 160; Weston . . . 159
Cells: concentration, electromotive forces, 5; hepatic, action on phenol and indol 27
Cement, effect of salt water on . . . 124
Cerium, volumetric estimation . . . 17
Chemicals, electrolytic process for manufacture . . . 124
Chemistry, physical, relation to technical chemistry . . . 71
Chloral, boiling-point of mixtures of, and water, 157; hydrate, melting-point . . . 72

Digitized by Google

Chloracetic acids, action of water on . . . 33
Chlorbutyric acids, action of water on . . . 33
Chlorine: heptoxide, 114; solutions, color, 14; normal, map of L. I . . . 128
Chromates, double . . . 153
Chromium: electrolytic separation from copper, 13; occurrence in peats, 152; estimation, in steel, 16; cell for rectifying alternating currents, 159; sulphate, green, 70, 71; salts, change in color . . . 70, 71
Ciminite . . . 82
Ciscampholytic acid, structure . . . 92
Citric acid: solutions, specific gravity and conductivity, 76; acid sodium salt, toxic action . . . 157
Clay, determination of fusibility . . . 41
Clays: analysis, 40; cretaceous, 86; fire, resistance to fluxes . . . 41
Coal: analysis, report of committee on, 81; analyses, 84; origin, occurrence, analysis, 85; determination of volatile combustible matter in, 103; determination of phosphorus in . . . 82
Cobalt: atomic weight, 69; occlusion of hydrogen by, 12: electrolytic separation from copper, 13; separation from nickel, 151; cobalticyanide, 65; sulphide, precipitation in tartrate solution, 155; tartrate . . . 155
Cobalticyanides . . . 65
Coefficients: thermal, 9; thermal and dynamic . . . 74
Coerulein, constitution . . . 130
Coke: determination of phosphorus in, 82; determination of volatile combustible matter in . . . 103
Colloids: emission and absorption of water by, 74, 157; precipitation . . . 144, 145
Color of bromides and iodides, effect of low temperature on . . . 153
Cumbustions, organic . . . 130
Conductivity, electrical: apparatus for determining, 109; determination, 161; of certain salts and acids, 76; of double salts, 1; of liquid ammonia solutions, 158; of benzoic acid, influence of constituents on, 10; of non-aqueous solutions, 10; of chlorides and bromides of alkaline earths . . . 72
Copper: atomic weight, 77; electrochemical equivalent, 76; electrolytic determination, 150; electrolytic separation, 13; occlusion of hydrogen by, 12; precipitation by zinc, 16; specific heat, 9; cobalticyanide, 65: double chloride, and potassium, repeated use, 122; matte, purification, 47; nitrate conductivity of liquid ammonia solutions, 158; ores, roasting, 45; silicide use in castings, 44; voltameter, polarization, 78; See also Cuprous.
Coral, occurrence of iodine in . . . 163
Corundum, new occurrence . . . 170
Creatinin, reducing power . . . 129
Crystallization, influence of magnetic field on . . . 157
Cupel machine . . . 59
Cupellation without muffle . . . 59
Cupola practice . . . 55, 56
Cuprous chloride, compound, wtth carbon monoxide . . . 12
Curves, boiling-point . . . 7
Cyanamides, constitution . . . 136
Cyanide process: oxygen in, 119; for gold ores . . . 52, 53

DEGRAS . . . 127
Delequescence of nitrates . . . 7
Dextrose, effect on the production of toxin . . . 27
Diabase, weathering . . . 87
Diagram, triaxial, for representing properties of slags . . . 53
Diagrams, pressure-temperature . . . 5
Diazocaffeine . . . 37
Di-*p*-brombenzylcyanamide, structure . . . 136
a-Dibromdinitrobenzene, structure . . . 36

Digitized by Google

β-Dibrom-*o*-dinitrobenzene 36
Dibromdiphenylchinoxaline 37
Dibromphenanthrophenazine 37
Dibromphenylenediamine 37
2, 6-Dicarboxy-4-nitro phenol 137
Dietary studies 99, 166
Diethoxysuccinic ester 38
Dikes, formation 85
α-μ-Diketotetrahydrothiazole derivatives 139
Dimethylamine, double halides with tellurium 152
Dimethyldiphenyltetrazone 35
Dinitrophenoxozone 39
2-6-Diphenyl-4-nitrophehol 137
Dissociation: experiments to illustrate, 141; electrolytic and toxic effect, 6; of acids and their tests, 121: of acid salts and their taste, 73, 147; of double salts, 2: certain salts, 76; pressure, history, 8; studies, 5; theory, application to solutions of two electrolytes with a common ion 76
Distillation, fractional, tower for 108
Drift, chemical weathering 86
Drugs: adulteration, 99; assay 165
Dyes, coal tar, detection in fruit products 168
Dynamite, analysis 20

EGG-WHITE, proteids 161
Egg-yolk, proteids 161
Electrochemistry, lecture experiments on 160
Electromotive force, determination 160
Energy: theory, 8; free, general equation for, 1; metabolism in human body, 28; conservation, in human body 28
Entropy: and heat capacity, 147; theory 147
Equilibrium: experiments to illustrate, 141; physico-chemical, general equation for, 1; of a one-component system 8
Ether, freezing-point of aqueous solutions 142
Ethyl: alcohol, compound with phenyl mustard oil, 37; anilinomalonate, action of nitrous acid on 137
Ethylamine, double halides with tellurium 115
Evaporation, relation between, and pressure 9
Experiments: lecture, in general chemistry, 141; lecture, in electro-chemistry . 160
Extracts, flavoring, artificial 19

FAT: origin from protein in phosphorus poisoning, 27; determination in condensed milk, 167, 168; extractor 108
Fats, rancidity 104
Feces, occurrence of xanthine bases in 162
Feeding-stuffs, digestibility 128
Ferric chloride, conductivity of the solutions, in organic solvents 10
Ferrosilicon, analyses 82
Fertilizer industry 123
Fertilizers: analyses, 26, 101, 123: estimation of nitrogen in 17
Fiber, digestibility 165
Fibrinogen, origin 29
Flesh, horse, analyses for glycogen 102
Flour: proteids in, 100; gluten constituents 128
Fluxes, influence on fire-clays 41
Food: adulteration, 99; material, Chinese, 26; value of sorghum, as 100
Formaldehyde: comparison of tests for, 97; tests for 102
Formylphenylacetic ester, melting-point 74
Freezing-point: minimum molecular lowering, 141; abnormal, of chlorides of alkaline earths, 72; of aqueous solutions of non-electrolytes, 142; curve for water, hydrochloric acid, and phenol 76

Digitized by Google

Fuel, use in stamp mill . . . 118
Furfuroids, digestion and assimilation . . . 166
Furimidomethylester . . . 93
Functions, thermodynamic fundamental . . . 157

GALLEIN: constitution, 134; ethers, 135; triphenylcarbonate . . . 135
Gallin, constitution . . . 134
Gallol, constitution . . . 134
Gas, blast-furnace, analysis . . . 54
Gases: apparatus for analysis, 106; explosive, non-explosive combination . . . 75
Gelation, mechanism . . . 145
Geology: of Iowa, 84; of Nicaragua canal route . . . 86
Glass-making in the U. S . . . 22
Glaucochroite . . . 66
Globulin, precipitation . . . 30, 164
Glucose, influence on crystallization of salts . . . 157
Glycogen: determination, 102; formation, after inulin feeding . . . 163
Gold: assay, new furnace for, 59; assay in telluride ores, 60; cyanide process, 52, 53, 119; iodometric estimation, 17; metallurgy, 50; pocket deposits, origin, 87; proof, 59; refining, 42, 43, 117, 118; carbide, 65; colloidal precipitation, 145; mills, 48; placer, separation from sand . . . 48
Gold-sodium chloride . . . 154
Graftonite, composition . . . 68, 171
Granodiorite . . . 83
Graphite, determination . . . 80

HANCOCKITE . . . 66
Heat: of dilution of salt solutions, 74; specific, of solutions of non-electrolytes, 11; specific of metals . . . 9
Helium, position in scheme of the elements . . . 157
Hippuric acid, production in rabbits . . . 98
Hübl's reagent, preservation . . . 21
Humus, amount of nitrogen in, 25; determination, composition, and nitrification . 164
Hydrastine, estimation . . . 22
Hydrastis Canadensis, assay . . . 22
Hydrates in solution . . . 9
Hydrazones, structure . . . 35
Hydrochloric acid, freezing-point . . . 74
Hydrogallein, structure . . . 134
Hydrogen: estimation, 21, 130; occlusion by cobalt . . . 12
Hydrometamorphism . . . 87
Hydrosols, irreversible, stability . . . 144
Hydroxyl group, detection of . . . 37
Hydroxylamine, action on ethyl tartrate . . . 138

ICE, coefficient of expansion . . . 10
Imido-esters, rearrangement . . . 92
Indicators, wide occurrence in nature . . . 166
Indigo, formation from diphenyldiketopiperazine . . . 140
Ingots, form . . . 44
Insecticides: adulteration and analysis, 149; analysis . . . 168
Iodides, effect of low temperature on color . . . 153
Iodine: absorption by oils, 103; occurrence in corals . . . 163
Iron: action of hard water on, 22: atomic weight, 143; determination in phosphates, 130; determination of carbon in, 17, 122, 131; electrolytic separation from copper, 13; specific heat, 9; thermochemistry, 115; bar, improvements in manufacture, 57; cast, physics, 56; cobalticyanide, 65; pig, estimation of sulphur in, 16; pig, determination of phosphorus in, 82; malleable, industry of the U. S., 57; malleable, basic furnace for, 57; meteoric,

Digitized by Google

68; mining, 84; ores of Pa., 169; ores of Lake Superior, analyses, 84; See Ferrous and Ferric.
Isonitrosoguaiacol, stereochemistry of ethers 37

KILN, roasting 116
Krypton: position in the scheme of the elements, 157; spectra 12
Kynurenic acid, excretion 29

LEAD: action of hard water on, 22, estimation of zinc, 16; alloys with tin and antimony, testing, 42; amalgams, electrical resistance, 3; ores, smelting, 42; refining, 43; smelting 43, 117
Lecithin, in egg yolk 161
Lemon, artificial extract 19
Leucitite 83
Leucophenicite 66
Licorice pastes, analysis 102
Lime, removal from natural waters 23
Liquids: molecular weight, 3, 4; mixtures, with constant boiling-points 75
Lithium: preparation, 111; conductivity, dissolved in liquid ammonia 158
Lupinus albus, toxic action of certain salts on 157

MAGNESIA: removal from natural waters, 23; volumetric determination 80
Magnesium: ammonium arseniate, constitution, 81; chloride, solutions, specific gravity and conductivity, 76; sulphate solutions, specific gravity and conductivity 76
Magnetic field, influence on crystallization 157
Malic acid, acid sodium salt, toxic action 157
Malonic ester, sodium derivative, action on nitro-compounds 133
Manganese: electrolytic separation from copper, 13; influence on cast iron, 56; cobalticyanides 65
Manganous chloride, transition temperature 147
Mass law and physical reactions 120
Medal, Kytchtym 55
Melting-points, apparatus for determining 107
Mercuric iodide, effect of solvents on 62
Mercury: assay, 60; determination as oxalate, 150; surface-tension, influence of electrification on, 78; cobalticyanide 65
Metabolism, in human body 28, 99
Metals: action of hard waters on, 22; electrolytic deposition from non-aqueous solutions, 158; influence on plants, 28; specific heat 9
Metanethol 94
Meteorite, analysis 83, 84, 169
Methane, estimation 21
Methyl alcohol, compound with phenyl mustard oil 37
Methylamine, double halides with tellurium 115
Methylamines; double halides with tin, 62; double halides with cadmium 61
o-Methylaminophenol 91
Methyl pyromucamide 93
Milk: coloring-matter in, 101: condensed, determination of fat in 167, 168
Mill: for working gold ores, 119; practice 51
Mills, gold, trolley for 119
Mineral resources of N. B., 83; N. S., ... 83
Minerals, new, from zinc mines 66
Mines, Mercur 50
Mixtures, ternary 5, 6
Molecular weights of liquids 3
Mould, ingot 44
Mucin: chemistry, 98; presence, in muscle 163
Muscle, connective tissue in 163

Digitized by Google

α-NAPHTHOQUINONEBENZOYLPHENYLHYDRAZONE 35
Naphthylamine, action on camphoroxalic acid 94
β-Naphthylimidoethyl ester 93
Nasonite 66
Natrolite, action of ammonium chloride on 171
Nickel: determination, 131; determination in ores, 81: determination in steel, 15; electrolytic separation from copper, 13; separation from cobalt, 151; occlusion of hydrogen by, 12; carbonyl, decomposition in solution, 66: cobalticyanide, 65; sulphide, precipitation in tartrate solution, 155; tartrate . . . 155
Nitrites, formation in combustion and in breathing 26
Nitro compounds, action of sodium salts of esters on 133
p-Nitro-*o*-benzoylbenzenesulphonic acid 96
Nitrogen: determination as ammonia, 130; estimation in fertilizers, 17; removal from the air by plants, 123; elimination after ingestion of proteid food, 127; iodide, preparation and properties 112
Nitromalonic aldehyde, condensation with ketones 137
5-Nitro-2-oxyphenylacetic acid 137
p-Nitrophenol, conductivity of liquid ammonia solutions 158
p-Nitrophenylethyl carbonate 91
p-Nitro-*o*-sulphobenzoyl chlorides 96
Nitrovanillic acid 140
Nitrovanillin 140

OIL: analysis, Hübl's iodine method, 103; sod 127
Oils: determination of bromine absorption, 103; essential, analysis 104
Opium, assay 19
Ores: Jackson system of treating, 48; copper, roasting, 45; iron, of Pa., 169: nickel, analysis, 81; telluride, assay for gold, 60; zincose lead, smelting 42
Oxalic acid: presence in human body, 163; acid sodium salt, toxic action, 157; solutions, specific gravity and conductivity 76
Oxaluria, fermentative origin 63
Oxyazo compounds, structure 34
Oxygen: atomic weight, 70; cause of evolution, when oxidizable gases are absorbed by permanganic acid 112
o-Oxyphenylmethylurethane 91
o-Oxyphenylurethane 89

PALLADIUM: atomic weight, 4; double halides with organic bases. 4
Paranuclein, presence of phosphorus in 162
Parianite 124
Pectolite, action of ammonium chloride on 171
Pentosans, digestion and assimilation 165, 166
Permanganic acid: action on oxidizable gases, 112; conductivity, 113; preparation by electrolysis 113
Petroleum: Texas, 127; Wyoming 24
Phase rule, demonstration 5
Phenite, action of ammonium chloride on 171
Phenol: action of hepatic cells on, 27; freezing-point in presence of water and hydrochloric acid 120
Phenoxozone 39
Phenyl mustard oil: use in detecting hydroxyl group, 37; compounds with alcohols 37
o-Phenylenediamine, action on camphoroxalic acid 94
Phenylhydrazines, acylated, action on quinones 97
Phosphates: elimination after ingestion of proteid food, 127; solutions, electrolysis 13
Phosphoric acid: estimation, 16; solutions, specific gravity and conductivity . . 76
Phosphorus: determination in ores, coal, and steel, 82; influence on cast iron, 56; presence, in the paranuclein from casein, 162; poisoning, 27, 30; heptabromide, 154; pentabromide, allotropism 153

Digitized by Google

Physiography of Nicaraugua canal route 86
Picryl chloride, action on pyrocatechin 39
Plants, influence of metals on 28
Potash, presence in lead slags 42, 43
Potassium: conductivity, dissolved in liquid ammonia, 158; chlorate, electrolytic reduction, 78; iodide, conductivity of liquid ammonia solutions, 158; nickel tartrate, 155; nitrate, deliquescence, 7; sodium sulphites, isomeric, 111; xanthate, preparation 131
Potatoes, starch content 101
Potential, differences between metals and solutions of their salts 11
Pressure: apparatus for carrying out chemical reactions under, 108; relation between, and evaporation 9
Proteids of wheat flour 100
Protopine, occurrence in a new plant 165
Prunes, analyses 101
Pyridine, double halides with tellurium 115
Pyrocatechin, action of picryl chloride on 39

QUARTZITE, Blue Mound 87
Quinazolines, synthesis 97
Quinoline, double halides with tellurium 115
Quinonebenzoylphenylhydrazone 34
Quinones, chlorinated, action of phenyl hydrazines on 97

RACEMIC acid, action of magnetic field on 156
Racemic compounds, separation 96
Racemism, history 98
Reaction, physico-chemical, driving tendency 143
Reactions: physical and the mass law, 120; reversible, 5; reversible, experiments to illustrate 141
Reductor, simplified 106
Ricidine 40
Ricinine 40
Roasting, reducing value for arsenic 45
Rock-weathering . . . . .
Rocks: volcanic, analyses, 82; differentiation, 85; copper-bearing 85
Rotation, magneto-optic, relation to structure 156
Ruby, new mode of occurrence 67

SACCHARIN, valuation 21
Saliva, influence of acids on action 163
Salts: heat of dilution of solutions, 74; inversion of sugar by, 4; acid, relation between taste and dissociation, 73; double, conductivity of 1
Sanguinarine nitrate 166
Scapolite from Alaska 170
Schists, ore-bearing 85
Scolecite, action of ammonium chloride on 171
Scorification without muffle 59
Selagite 82
Selenium: allotropic forms, 147; detection in presence of tellurium, 63; isomorphism with tellurium, 152; separation from tellurium, 116; dioxide, reduction by sodium thiosulphate 64
Semicarbazide, action on camphoroxalic acid 94
Serpentinization 87
Serum: diphtheretic, 30; of horse, antitoxic strength 164
Sesquiterpenes, classification 39
Silicon: amount in ferrosilicon, 82; determination in ferrosilicon, 150; influence on cast iron, 56; standards in water analysis, 20; use in iron castings . . . 44

Digitized by Google

Silver: electrochemical equivalent, 76; electrolytic deposition from non-aqueous solutions, 158; losses in smelting, 42; occlusion of hydrogen by, 12; proof, 59; refining, 42, 43, 117, 118; assay, new furnace for, 59; cobalticyanide, 65; lead bullion, sampling, 58; nitrate, conductivity in organic solvents, 10; voltameter, study of, 78; plating of amalgam plates 49
Slag: utilization, 55; molten, utilizing heat 117
Slags: determination of lime in, 82; lead potash and soda salts, in 42
Smelting, silver, 42; lead 42
Smoke, collecting solids from 118
Soda, presence in lead slags 42, 43
Sodium: conductivity, dissolved in liquid ammonia, 158; acid salts of oxalic, tartaric, malic, and citric acids, toxic action, 157; alcoholates, action on nitro compounds, 133; ammonium chromates, 153; chloride, electrolysis, 159; hydroxide solutions, specific gravity and conductivity, 76; nitrate, deliquescence, 7; nitrite, manufacture, 23; phenolate, action on nitro compounds, 133; phosphates, solutions, specific gravity and conductivity, 76; potassium sulphites, isomeric, 111; sulphate transition temperature 147
Soil: analysis, 128; humus 129
Soils: composition, 100; determination of lime requirement, 103; testing for application of fertilizers 26
Solutions: isohydric, 121; solid, 5; specific heat, 11; non-aqueous, conductivity, 10; non-aqueous, potential differences 11
Sorghum, feeding value 100
Specific gravity of certain salt solutions 76
Stamp-mill: portable, 118; water required for 48; water and fuel economy in . . 118
Stannic chloride: hydrolysis, 3; double salts with organic bases 62
Stannous chloride, double salts with organic bases 62
Starches, digestibility 165
Stearic acid, sulphonic derivatives 40
Steel: determination of carbon in, 122, 131; determination of chromium in, 16; determination of nickel in, 15; determination of phosphorus in, 82; relation between chemical composition and physical character, 58; thermochemistry 115
Stereoisomers: equilibrium, 6; separation 96
Strawberries, analyses 128
Strontium chloride solutions, abnormal freezing-point 72
Succinic acid, acid sodium salt, toxic action 157
Sugar: freezing-points of aqueous solutions, 142; inversion, 4, 167; test for, in urine, 19; beets 167
Sugars, digestibility 165
Sulphates, elimination after ingestion of proteid food 127
Sulphohalite, composition 170
Sulphur: molecular weight, 6; conductivity, dissolved in liquid ammonia, 158; determination in pig iron, 16; determination in bitumens, 80; monochloride, action on tungsten compounds 13
Sulphuric acid: determination in presence of iron, 143; determination photometrically, 131; molecular weight, 71; surface-tension 71
Surface-tension: influence of electrification on, 78; of sulphuric acid solutions . . 71
Syenite, nepheline, new occurrence 68
System, periodic of elements 148

TANNIN, estimation 21
d-**Tartaric acid**, change in magnetic field 156
Tartaric acid, acid sodium salt, toxic action 157
Tartaric ester, action of ethyliodide and sodium ethylate on 38
Taste of acids, relation to dissociation 121
Taste of acid salts, relation to their dissociation 73, 147

Digitized by Google

Tellurium : isomorphism with selenium, 152 ; specific gravity and electrical resistance, 79, preparation, 63, 114 ; separation from selenium, 116 ; basic nitrate, 63 ; dioxide, yellow form, 114 ; double halides with organic bases, 115 ; double halides with dimethylamine 152
Tetramethylammonium : double halides with tin, 62 ; double halides with cadmium 61
2, 3, 3-Tetramethylhexoic-1, 2, 6-acid 92
Thallium, estimation 18, 81
Thallous sulphate, transition temperature 147
Theorem, Maxwell's 5
Theorems, Gibbs' 121
Thioncarbamic esters, molecular rearrangement 138
Thioncarbanilic esters, molecular rearrangement 138
Thioncarbazinic esters, molecular rearrangement 138
Thiourea, conversion into ammonium thiocyanate 4
Tin : alloys with lead, testing, 42 ; qualitative test for, 130, 149, 151 ; double halides with organic bases, 62 ; See also Stannous and Stannic.
Titanium, occurrence in peats 152
p-Tolenylimido methylester 93
Toluidines : double halides with antimony, 65 ; double halides with tin 62
Toluquinonebenzoylphenylhydrazone 35
Toluquinoneoxime, ethers, stereochemistry 36
Tourmaline, estimation of boric acid, in 15
Toxic effect : and electrolytic dissociation, 6 ; of acid sodium salts 157
Transition temperature 146
2-4-6-Tribrombenzamide, compound, with sodium hydroxide 136
Triethylamine, double halides with tin 62
Trimethylamine, double halides with tellurium 115
2-4-6-Trimethylbenzamide, compound, with sodium hydroxide 136
Trinitranisol, action of certain sodium salts on 133
Trinitrobenzene, action of certain sodium salts on 133
Tungsten : atomic weight, 13 ; alkyls, 13 ; compounds, action of sulphur monochloride on, 13 ; oxytetrachloride 13
Tungstic acid, esters 13
Turquois, composition 170
Tuyeres, in blast-furnace 53

UREAS, action of acid reagents on 98
Uric acid : reducing power, 129 ; formation after splenectomy 162
Urine : normal reducing power, 129 ; of vegetarians, 164 ; test for sugar in 19

VANADIUM, occurrence in peats 152
Vanillin, action of nitric acid on 140
Vapor-pressure in mixture of two liquids 146
Vapors, mixed, composition 5
Veins, formation 85
Vinegar, analysis 101

WATER : analysis, 166 ; estimation of suspended matter in, 20 ; rate of action on halogen fatty acids, 33 ; removal of lime and magnesia from, 23 ; use in stamp-mill, 118 ; surface-tension, influence of electrification on, 78 ; boiler, quality, 24 ; boiler, chemistry, 24 ; hard, action on metals, 22 : salt, effect on cement 124
Weights : molecular, of liquids, 3 ; standardizing 106
Wells, artesian 84
Wheat : gluten constituents, 128 ; protein compounds, 162 ; embryo, nucleic acid in 162
Wheels, car, manufacture 56
Wool : mineral, manufacture, 54 ; grease 127

Digitized by Google

XANTHINE bases, origin, in feces 162

ZINC : determination, 16, 122, 131 ; action of hard water on, 22 ; electrolytic seperation from copper, 13 ; solution-tension in alcohol, 158 ; cobalticyanide, 65 ; ethyl, preparation, 138; mines, new minerals from, 66; sulphate, hydrates, inversion in a Clark cell 79

Digitized by Google

Digitized by Google

Digitized by Google

REVIEW

—OF—

American Chemical Research

VOL. VII. 1901.

Contributed by Members of the Instructing Staff of the Massachusetts Institute of Technology.

ARTHUR A. NOYES, Editor.
A. G. WOODMAN, Associate Editor.

REVIEWERS.

ANALYTICAL CHEMISTRY.....H. P. Talbot and F. J. Moore
BIOLOGICAL CHEMISTRY.....A. G. Woodman
CARBOHYDRATES.....G. W. Rolfe
GENERAL CHEMISTRY.....A. A. Noyes
GEOLOGICAL AND MINERALOGICAL CHEMISTRY.....
.....W. O. Crosby and C. H. Warren
INORGANIC CHEMISTRY.....Henry Fay
METALLURGICAL CHEMISTRY AND ASSAYING.....H. O. Hofman
ORGANIC CHEMISTRY.....J. F. Norris
PHYSICAL CHEMISTRY.....H. M. Goodwin
SANITARY CHEMISTRY.....E. H. Richards
INDUSTRIAL CHEMISTRY.....A. H. Gill and F. H. Thorp

EASTON, PA.:
THE CHEMICAL PUBLISHING COMPANY
1901

Digitized by Google

Digitized by Google

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 1.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. G. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

The Transition Temperature of Sodic Sulphate, a New Fixed Point in Thermometry. BY THEODORE WILLIAM RICHARDS. *Am. J. Sci.*, **156**, 201–208.—The author has accurately determined the melting-point of hydrated sodium sulphate, and finds it to be 32.48° according to the mean mercury thermometer. He strongly recommends the use of this salt for the standardization of thermometers, and describes the precautions to be observed. The chemically pure commercial salt is recrystallized twice, or better, until its melting-point is constant; it is then pulverized and partially melted in a wide test-tube over a flame, so as to form a pasty mass; a little powdered anhydrous sodium sulphate is added, the tube is inserted in a wider glass tube serving as an air-jacket, the whole is placed in a water-bath 0.5°–3.0° above the melting-point, and the semi-liquid mass, in which the thermometer is placed, is gently stirred.

The Use of the Transition Temperatures of Complex Systems as Fixed Points in Thermometry. BY THEODORE WILLIAM RICHARDS AND JESSE BRIGGS CHURCHILL. *Proc. Am. Acad.*, **34**, 277–280.—In reply to a note by Meyerhoffer and Saunders, the authors claim priority with respect to the matter stated in the title, and emphasize the advantages of using, for the purpose mentioned, the melting-point of a single hydrated salt over that of mixtures of salts. They give the approximate melting-points of nine salts, melting between 19.7° and 78°, which have been found suitable for the standardization of thermometers.

On the Dissociation of Phosphorus Pentabromide in Solutions in Organic Solvents. BY J. H. KASTLE AND W. A.

Digitized by Google

BEATTY. *Am. Chem. J.*, **21**, 392–398.—Carbon disulphide and carbon tetrachloride solutions of phosphorus pentabromide of 0.025–0.001 molar concentration are found to have the same color as solutions in the same solvents containing a nearly equal number of bromine molecules, thus indicating that the dissociation is nearly complete. The addition of phosphorus tribromide to a carbon disulphide solution of the pentabromide causes it to become lighter in color.

On an Apparatus for Measuring Very High Pressures. BY A. DE FOREST PALMER, JR. *Am. J. Sci.*, **156**, 451–454.—The method consists in determining the change in electrical resistance produced by subjecting a mercury thread contained within a glass capillary tube to the pressure to be measured. With the help of the coefficient of change of resistance with the pressure previously determined by the author (*Am. J. Sci.*, **154**, 1), the pressure is readily calculated. It is stated that the error does not exceed 0.1 per cent., up to pressures of 2000 atmospheres.

The Compressibility of Colloids, with Applications to the Jelly Theory of the Ether. BY C. BARUS. *Am. J. Sci.*, **156**, 285–298.—It is found that the compressibility of *liquid* colloidal solutions (those of gelatine and albumen in water and of India rubber in ether) is not essentially different from that of the solvents, notwithstanding the great differences in viscosity; but that the same solutions, when coagulated or solidified, have a very much less compressibility, which, however, could not be measured by the method used owing to the occurrence of the following remarkable phenomenon: the mercury meniscus, at which the pressure was transmitted to the jelly in a capillary tube, assumed with increasing pressure a conoidal form, and threw off little globules of mercury which were projected with a jerky motion, even for a distance of 20 cm., through the jelly. The author attributes the phenomenon to the temporary breaking down of the thread of solid jelly in the middle of the tube, where it is least supported, and suggests that the inertia of matter and the phenomenon of the electric spark may be due to a similar behavior of the hypothetical ether.

On Some Experiments with Endothermic Gases. BY W. G. MIXTER. *Am. J. Sci.*, **157**, 323–327.—Acetylene is invariably caused to explode by large sparks or a red-hot platinum wire when the pressure is as high as three atmospheres, while at lower pressure these agents often fail to cause explosion. Small sparks, moreover, do not cause it even at much higher pressures. On the other hand, cyanogen does not explode when heavily sparked at five atmospheres, nor does nitrous or nitric oxide do so at twenty atmospheres. A simple experiment is also described

Digitized by Google

illustrating the spontaneous decomposition of acetylene, and the accompanying evolution of heat: a slow current of the gas is caused to issue from a small tube into a larger one surrounding it, the latter being heated to dull redness by a burner at the place where the small tube ends. The jet is then seen to be filled with a cloud of glowing lampblack.

Some Boiling-point Curves. By C. L. Speyers. *Am. J. Sci.*, **159**, 341–344.—Under the assumption that the vapor-pressure equation $\frac{p-p'}{p} = \frac{n}{n+N}$ holds true for both components of a liquid mixture at all concentrations, the author has calculated the boiling-points of mixtures of carbon tetrachloride and benzene, carbon tetrachloride and chloroform, and chloroform and benzene, and compared the results with existing experimental data. The agreement is found to be close for the first two mixtures, but poor for the last one, perhaps owing to experimental errors. Hereto the reviewer would remark that, since two components whose vapor-pressures in the presence of each other are expressed by the above equation, cannot form a constant-boiling mixture, and since constant-boiling mixtures are extremely common where the boiling-points of the pure components do not differ greatly from each other (see *this Rev.*), the equation cannot at best, have more than a very limited applicability.

Lecture Experiments Illustrating the Electrolytic Dissociation Theory and the Laws of the Velocity and Equilibrium of Chemical Change. By A. A. Noyes and A. A. Blanchard. *J. Am. Chem. Soc.*, **22**, 726–752.—Seventeen experiments on the subjects stated in the title are described. Full details are given both for the preliminary preparation and the execution of the experiments, and the principles illustrated are explicitly stated.

On the Periodic System and the Properties of Inorganic Compounds. By James Locke. *Am. Chem. J.*, **20**, 581–592.—The article is principally devoted to the discussion of the important fact that the relations of the periodic system are only apparent when each element is considered in a particular one of its various states of oxidation. The author believes that the discovery of general principles can only be arrived at by a comparison of the physical properties and chemical reactions of compounds of the various elements in the *same* state of oxidation, and promises soon to publish the results of such an investigation.

Digitized by Google

ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

Molecular Dissociation of Nitroso Compounds. BY EDWARD KREMERS. *Pharm. Archives*, 1, 102–107.—The author discusses the change in color from white to blue of nitroso compounds, and comes to the conclusion that true nitroso compounds are bimolecular and that they become monomolecular when heated in solution. This dissociation is accompanied by a change in color. Exception is taken to the theory put forward by Baeyer in connection with these compounds.

Note on the Crystallography of a Reduction-product of Δ^4-Terpen-3-one. BY WILLIAM H. HOBBS. *Pharm. Archives*, 2, 21–23.

Some of the Unpublished Results of the Investigations of the Tannins by the Late Professor Henry Trimble. BY JOSIAH C. PEACOCK. *Am. Jour. Pharm.*, 72, 334–343.—The results of a large number of analyses of tannins from different sources are given. The hide-powder method was used exclusively in the work.

Note on Testing Formaldehyde. BY LYMAN F. KEBLER. *Am. J. Pharm.*, 70, 432–433.—In making a quantitative determination of formaldehyde by means of ammonia, it was found necessary to let the solutions remain in contact with one another for six hours in order to effect complete reaction. At the end of fifteen minutes, reaction had taken place to the extent of about one-half the total amount.

On the Preparation of Nucleic Acids. BY P. A. LEVENE. *J. Am. Chem. Soc.*, 22, 329–331.—Nucleic acid was prepared from the extract obtained by treating flesh tissues with sodium hydroxide. The solution was nearly neutralized with acetic acid, and picric acid was added to precipitate the proteid material. The acid was obtained by precipitating it from the filtered solution by means of alcohol.

On Urea-imido Esters, Thio-urea-imido Esters, Acylthiourea-imido Esters, and Urea-amidines. BY HENRY L. WHEELER AND W. MURRAY SANDERS. *J. Am. Chem. Soc.*, 22, 365–379.—It is shown that representatives of new classes of compounds, isomeric or metameric with the acylpseudourea ethers, acylpseudothiourea ethers, and diacylpseudothiourea ethers can be prepared by combining isocyanates, mustard oils, and acylsulphocyanates with imido esters. The preparation and properties of a number of new substances belonging to these classes are described.

Digitized by Google

The Direct Synthesis of Ketodihydroquinazolines from Ortho-amino Acids. By MARSTON TAYLOR BOGERT AND AUGUST HENRY GOTTHELF. *J. Am. Chem. Soc.*, **22**, 522–536.—The authors discuss fully the probable course of the reaction between anthranilic acid and acetonitrile by which 2-methyl-4-ketodihydroquinazoline is formed, and describe the hydrochloride, chlorplatinate, nitrate, chromate, and methyl ether of the quinazoline derivative.

On the Hydrocarbons in Heavy Texas Petroleum. By CHARLES F. MABERY AND D. M. BUCK. *J. Am. Chem. Soc.*, **22**, 553–556.—From analyses and molecular weight determinations of the fractions obtained by distilling a heavy Texas petroleum under diminished pressure the conclusion is drawn that the oil contains hydrocarbons from $C_{14}H_{26}$ to $C_{19}H_{36}$ of the series C_nH_{2n-2}, and higher hydrocarbons $C_{21}H_{38}$ to $C_{25}H_{46}$ of the series C_nH_{2n-4}.

The Action of Sodium Alcoholate upon Anisylidene Acetophenonedibromide. By F. J. POND AND ARTHUR S. SHOFFSTALL. *J. Am. Chem. Soc.*, **22**, 658–685.—In a former paper (*this Rev.*, **5**, 129) it was stated that sodium methylate reacts with the dibromides of certain unsaturated ketones of the general formula $R.CH:CH.CO.C_6H_5$, yielding 1,3-diketones of the formula $R.CO.CH_2.CO.C_6H_5$. The authors now show that the reaction-products have the formula $R.C(OH):CH.CO.C_6H_5$, for they form copper and iron salts, and exhibit the general reactions of compounds which contain the grouping —C(OH)=CH—. When a solution of anisylidene acetophenone dibromide in alcohol was boiled, hydrogen bromide was eliminated and an addition-product of monobromanisylidene acetophenone and alcohol was formed. By the action of hydroxylamine hydrochloride upon an alcoholic solution of α-oxyanisylidene, α,γ-methoxyphenylphenylisoxazole was produced. An isomeric isoxazole derivative was formed by the action of potassium hydroxide upon a mixture of anisylidene acetophenone dibromide and hydroxylamine hydrochloride. Bromine converts α-oxyanisylideneacetophenone into the compound $CH_3O.C_6H_4.CO.CHBr.CO.C_6H_5$. The reaction by which the enolic ketone is formed from anisylidene acetophenone dibromide was shown to take place in the manner represented by the following equations: $2RCHBr.CHBr.CO.R + 2NaOCH_3 = RCHBr.CH(OCH_3)CO.R + RCBr:CH.CO.R + CH_3OH + 2NaBr$; $RCBr:CH.CO.R + NaOCH_3 = RC(OCH_3):CH.CO.R + NaBr$; $RC(OCH_3):CH.CO.R + HOH = RC(OH):CH.CO.R + CH_3OH$. The intermediate products in the reaction were isolated and studied.

Digitized by Google

On the Preparation of Triphenylchlormethane. By M. Gomberg. *J. Am. Chem. Soc.*, **22**, 752–757.—It is shown that when carbon tetrachloride and benzene react in the presence of aluminum chloride, the product formed is triphenylchlormethane, and not triphenylmethane, the substance which heretofore has been considered the result of this reaction. When care was taken to prevent the decomposition of the reaction-product by water a yield of 87 per cent. of the theoretical quantity was obtained.

An Instance of Trivalent Carbon: Triphenylmethyl. By M. Gomberg. *J. Am. Chem. Soc.*, **22**, 757–771.—When a solution of triphenylchlormethane in benzene or carbon disulphide is treated with mercury, silver, or zinc, the halogen is removed and, in the presence of air, a precipitate is formed which was shown by analyses and molecular weight determinations to have the composition represented by the formula $(C_6H_5)_3C—O—O—(C_6H_5)_3$. If air is excluded, zinc removes the chlorine quantitatively from the halogen compounds dissolved in benzene in five to six days and no precipitate is formed. The solution so produced absorbs oxygen rapidly from the air, and the peroxide is precipitated. It absorbs chlorine, bromine, and iodine at 0° readily. When iodine was used triphenyliodomethane was formed. This compound was isolated and studied. The author considers that the highly unsaturated substance formed by the reaction is the radical triphenylmethyl, $(C_6H_5)_3C—$, as it is evidently not hexaphenylethane, $(C_6H_5)_3C—C(C_6H_5)_3$, the substance which might be expected as the result of the action of a metal on triphenylchlormethane, $(C_6H_5)_3C.Cl$. The structure of the oxygen compound found by the action of oxygen on the unsaturated substance was shown to be $(C_6H_5)_3C—O—O—C(C_6H_5)$ by preparing it from triphenylchlormethane and sodium peroxide. The peroxide is converted by concentrated sulphuric acid into triphenylcarbinol and gives a hexanitro derivative when treated with nitric acid.

Some Double Salts Containing Selenium. By James F. Norris. *Am. Chem. J.*, **20**, 490.—The double chlorides and bromides of selenium and dimethyl- and trimethylamine were prepared and studied. It was found that in some of the bromides selenium oxybromide was present. No salt containing selenium chloride could be isolated; selenium oxychloride and selenium dioxide, however, united with the hydrochlorides of the amines to form well crystallized compounds. Double salts containing the perbromides of the amines are also described.

The Purification of Phloroglucinol. By G. S. Fraps. *Am. Chem. J.*, **24**, 270–271.—Commercial phloroglucinol, which contains diresorcinol, is readily purified so that it can be used in the de-

Digitized by Google

termination of pentosans in vegetable materials by proceeding as follows: 11 grams of phloroglucinol are added to 300 cc. of hot dilute hydrochloric acid (sp. gr. 1.06). When only the insoluble impurities have not dissolved the solution is poured into 1200 cc. of cold hydrochloric acid of the same strength. The mixture is set aside for several days in order to allow the diresorcinol to crystallize out. The filtered solution is used in determining pentosans. Determinations of furfural by means of phloroglucinol purified in this way were in close agreement with those obtained when a chemically pure compound was used.

A New Synthesis of Secondary Amines. By ALFRED TINGLE. *Am. Chem. J.*, **24**, 276–281.—It has been previously shown by the author (*this Rev.* **6**, 138) that when methyl salicylate is boiled with aniline, the chief products are methylaniline and phenol. In the present paper, the action of aniline on ethyl and isoamyl-salicylate, and of ammonia on methylsalicylate is described. In all of these cases, a reaction similar to the one already reported was shown to take place, but only to a very slight degree. When ammonia was used, dimethylamine was formed. Isoamylsalicylate was prepared readily by boiling for three hours, a solution of salicylic acid in isoamyl alcohol containing a small amount of sulphuric acid.

The Electrolytic Oxidation of Toluene. By AARON MERZBACHER AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **22**, 723–725.—A mixture of toluene, alcohol, and sulphuric acid was placed within a porous cup containing the anode, and electrolyzed. Small quantities of resin, ethyl benzoate, and benzaldehyde were produced.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

Ferrous Iodide. By C. LORING JACKSON AND I. H. DERBY. *Am. Chem. J.*, **24**, 15–31; *Proc. Am. Acad.*, **35**, 213–227.—The many contradictory statements in regard to anhydrous ferrous iodide, have led the authors to prepare it by different methods, and to study carefully its properties. The most convenient method of preparing the substance is to pass iodine vapor over heated iron clippings. This is done in an apparatus consisting of three bicycle tubes so arranged that a current of nitrogen can sweep the iodine over the heated iron, and the ferrous iodide can collect in one of the tubes from which it can be easily removed. The anhydrous ferrous iodide forms crystalline plates of a deep red color with a slight brownish tint; in thick masses it is nearly black, and when melted it solidifies to a black-

Digitized by Google

ish red crystalline mass. The crystals belong to the hexagonal system. It can be sublimed in a stream of nitrogen; part of it is deposited in the red crystalline plates, and part is carried further on in the tube, where it deposits as a reddish brown amorphous powder. Heated in the air it loses iodine and leaves a residue of ferric oxide. Exposed to the atmosphere the salt deliquesces quickly to a brown solution. Thin plates kept in a desiccator gradually lose their color, passing over into a white salt, which is ferrous iodide with two molecules of water. The anhydrous ferrous iodide dissolves in water with considerable evolution of heat, and deposits from hot concentrated solutions green crystals of $FeI_2.4H_2O$. Ferrous iodide is very susceptible to the action of oxidizing agents, but shows a striking resistance to reducing agents. It may be sublimed in a current of dry hydrogen, and is not changed when distilled with mercury. It is reduced when melted with molecular silver. Exposed to a current of ammonia gas, ferrous iodine combines with it to form the substance $FeI_2.6NH_3$, which is a white amorphous powder easily decomposed by water, with formation of ferrous hydrate, ammonium iodide, and ammonia. When hexammonia ferrous iodide is exposed to the vapor of bromine it absorbs it in large quantity, giving a product which is probably a mixture of ferric bromide, ammonium bromide, and ammonium bromiodobromide, NH_4BrI-Br. This last named substance was prepared by treating ammonium iodide with bromine vapor. This salt has a blood-red color in transmitted light, but is a brilliant green with a metallic luster by reflected light.

The Action of Carbon Dioxide on the Borates of Barium. By H. N. Morse and D. W. Horn. *Am. Chem. J.*, **24**, 105-137. The method of Morse and Burton for the determination of boric acid consists in passing carbon dioxide into an alcoholic solution of boric acid, and a measured volume of standard barium hydroxide solution, and in igniting and weighing the residue of barium carbonate and barium metaborate. Jones (*this Rev.*, 5, 52), working in a similar manner with aqueous solutions, has criticized the method of Morse and Burton. He found it impossible to get constant results, and attributes these discrepancies to loss of boric acid. The authors point out that Jones made all of his experiments in aqueous solution, while theirs were made in alcoholic solution, which with the addition of the standard barium hydroxide solution, made the solution contain at least 78 per cent. alcohol. As the solubility of the metaborate is given as 1 part in 55,000, 125 cc. of the 78 per cent. liquid could not contain more than 2 milligrams of barium metaborate in solution. From this it would seem that carbon dioxide could hardly decompose the metaborate in solution as Jones alleges. In order to see whether

Digitized by Google

boric acid was lost on evaporation of the alcoholic solution the alcohol was distilled off in a current of carbon dioxide. Only traces were found in the distillate even when the alcoholic concentration of the distillate amounted to 92 per cent. The test for boric acid in the distillate was made by the flame test which was found to show about 1 part of the acid in 14,200 parts of alcohol. Evaporation of water solutions likewise showed no loss of boric acid. Solutions of boric acid and an excess of barium hydroxide were treated with carbon dioxide, and then the water was distilled off in a current of hot air. Turmeric paper, which would detect 1 part of acid in 59,000 parts of water by a single dipping, and 1 part in 143,000 by dipping four or five times, failed to show the presence of boric acid in the distillate. In heating the mixture of barium carbonate and metaborate, it was found that at a full red heat the metaborate attacks the carbonate with expulsion of carbon dioxide. The temperature at which a mixture of the metaborate and carbonate of barium is stable, and which is still sufficiently high to insure the dehydration of the former, appears to be just under a red heat. If a mixture of metaborate and carbonate has been heated so high that some of the latter has been decomposed with formation presumably of a more basic borate, the lost weight is restored by exposing the material to the air, and drying in the desiccator.

The Composition of Nitrogen Iodide. By F. D. Chattaway. *Am. Chem. J.*, 24, 138–158.—The reaction which takes place between sodium sulphite and nitrogen iodide was found to be a convenient means of studying the composition of nitrogen iodide prepared in various ways. The products of the reaction are sodium sulphate, ammonium iodide, and hydriodic acid. The free hydriodic acid was determined by means of standard alkali, the total amount of iodine by means of standardized silver nitrate, and the ammonia by distillation with potassium hydroxide. The ratio between nitrogen and iodine was determined in samples of nitrogen iodide prepared in the following ways: by adding a solution of iodine in potassium iodide to a solution of ammonia; by the action of a strong solution of ammonia upon solid iodine; by the action of an alcoholic solution of iodine upon ammonia; by adding ammonia to a solution of potassium hypoiodite, containing an excess of potash; and by the action of iodine monochloride upon ammonia. All the results show that the relation by weight between the nitrogen and iodine in the various specimens of nitrogen iodide analyzed, does not vary either with the mode of preparation or the state of aggregation of the compound, and that this relation is 2:3 when expressed in terms of the atomic weight of the two elements. When nitrogen iodide is exposed to sunlight, it breaks up quan-

Digitized by Google

titatively into nitrogen and hydriodic acid, which proves that the molecule of the compound contains only nitrogen, hydrogen, and iodine atoms, and that each atom of iodine is associated with one atom of hydrogen. The simplest formula which expresses the composition is $N_2H_3I_3$. Attempts were made to produce other compounds of nitrogen and iodine, but without success. The various analyses of previous workers differ so widely, because their substances were usually washed with water or some other substance which causes decomposition.

The Action of Light on Nitrogen Iodide. By F. D. Chattaway and K. J. P. Orton. *Am. Chem., J.*, **24**, 159–167.—When nitrogen iodide suspended in a solution of ammonia is exposed to light, nitrogen is evolved and the solid disappears, ammonium iodide and ammonium iodate being formed in the liquid. These substances are formed by two reactions which go on simultaneously. Under the influence of light, nitrogen iodide breaks down quantitatively into nitrogen and hydriodic acid. Some of the nitrogen iodide, however, is hydrolyzed; ammonium hypoiodite is formed, and is then transformed into ammonium iodide and ammonium iodate:

$$N_2H_3I_3 + 3H_2O = 2NH_3 + 3HIO$$
$$3HIO + 3NH_3 = 3NH_4IO = NH_4IO_3 + 2NH_4I.$$

The amount of hydrolysis varies with the temperature and the illumination, from 2-4 per cent. being hydrolyzed on a bright day, and 25 per cent. on a dull day. The iodine existing as hypoiodite may be determined by means of arsenious acid; the iodine existing as iodate by acidifying with sulphuric acid and titrating the liberated iodine with sodium sulphite. The decomposition of nitrogen iodide by light in the presence of water is similar to that with ammonia, but secondary reactions take place between the hydriodic acid and undecomposed nitrogen iodide, whereby iodine is set free. The red end of the spectrum decomposes nitrogen iodide most readily, and the action becomes less as the wave-length of the light used diminishes.

The Action of Alkaline Hydroxides, of Water, and of Hydrogen Peroxide Upon Nitrogen Iodide. By F. D. Chattaway and K. J. P. Orton. *Am. Chem. J.*, **24**, 318–330.—The action of water and of alkalies upon nitrogen iodide is chiefly a hydrolytic one, by which are produced ammonia and an alkaline hypoiodite which is unstable and rapidly changes into iodide and iodate:

$$N_2H_3I_3 + 3KOH = 2NH_3 + 3KOI = 2NH_3 + 2KI + KIO_3.$$

At the same time a portion of the nitrogen iodide breaks down into nitrogen and potassium iodide in this way:

$$N_2H_3I_3 + 3KOH = N_2 + 3KI + 3H_2O.$$

Digitized by Google

The extent to which each reaction takes place depends upon the conditions under which the decomposition is effected. Solutions of ammonia and of the alkaline earth hydroxides act similarly. Water causes analogous decompositions, but in this case some of the hypoiodous acid formed in the hydrolysis reacts with the hydriodic acid liberating iodine while any excess is transformed into iodine and iodic acid:

$$N_3H_3I_3 + 3H_2O = 2NH_3 + 3HOI$$
$$N_3H_3I_3 = N_2 + 3HI$$
$$HOI + HI = I_2 + H_2O$$
$$15HOI = 10HI + 5HIO_3 = 6I_2 + 3HIO_3 + 6H_2O.$$

Hydrogen peroxide dissolved in a solution of potassium hydroxide rapidly decomposes nitrogen iodide, ammonia, potassium iodide, and a trace of potassium iodate being produced. Oxygen and a little nitrogen are evolved.

The Action of Acids Upon Nitrogen Iodide. By F. D. CHATTAWAY AND H. P. STEVENS. *Am. Chem. J.*, **24**, 331–341. —Dilute acids when added to nitrogen iodide, suspended in water, first induce hydrolysis of the compound, and hypoiodous acid is liberated, together with ammonia which combines with the acid. If acids be employed upon which hypoiodous acid has no effect, a rapid change into hydriodic and iodic acids occurs, the former being immediately oxidized by the latter, setting free iodine. With hydrochloric, hydrocyanic, and hydriodic acids, the hypoiodous acid reacts forming respectively iodine monochloride, cyanogen iodide, and iodine. Most acids, if at all concentrated, act so violently as to produce explosions.

The Formation and Constitution of Nitrogen Iodide. By F. D. CHATTAWAY AND K. J. P. ORTON. *Am. Chem. J.*, **24**, 342–355.—The authors have studied quantitatively the actions of iodine and iodine monochloride on ammonia, the oxidation of sodium arsenite being used as a means of estimating hypoiodite, the formation of which always accompanies the formation of nitrogen iodide. In the case of free iodine exactly half, and in the case of iodine monochloride the whole of the iodine appears as nitrogen iodide and hypoiodite. The addition of ammonia to a solution of an alkaline hypoiodite is followed directly by the separation of nitrogen iodide. When an alkaline solution of potassium hypoiodite of known strength is used, and the hypoiodite estimated in the filtrate from the precipitated nitrogen iodide, the iodine as hypoiodite in the filtrate is found to be less than the iodine as hypoiodite originally present, by an amount which equals the iodine as nitrogen iodide. The latter is, therefore, formed at the expense of the hypoiodite, and the following

Digitized by Google

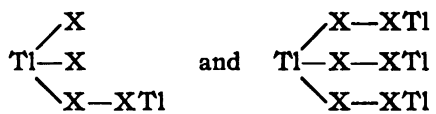
equations represent the action of iodine and iodine monochloride on solutions of ammonia :

$$I_2 + 2NH_4OH = NH_4I + NH_4OI$$
$$ICl + 2NH_4OH + NH_4Cl + NH_4OI$$
$$3NH_4OI = N_2H_3I_3 + 2H_2O + NH_4OH$$

There is little direct evidence from which to deduce a constitutional formula. The formula, $NH_3.NI_3$, seems most probable. Nitrogen iodide, which has been allowed to stand under water, becomes much more liable to explode, and analyses of partly decomposed material point to a disintegration of the molecule and a liberation of the very unstable NI_3 in the residue.

On the Effect of Oxidizing Agents on the Reduction of Mercuric Chloride by Oxalic Acid. By J. H. Kastle and W. A. Beatty. *Am. Chem. J.*, **24**, 182–188.—Potassium permanganate greatly accelerates the reduction of mercuric chloride by oxalic acid in the sunlight. Two tubes each containing 5 cc. of a 5 per cent. mercuric chloride solution, and 10 cc. of a 4 per cent. ammonium oxalate solution were placed side by side in direct sunlight. To one was added 1 drop of 0.01 normal potassium permanganate solution. After ten minutes the mercurous chloride was filtered off and determined in each. In the one to which the permanganate had been added 28.2 per cent. of the mercuric chloride had been reduced ; in the other only 3.48 per cent. About 1 drop of a 1/160,000 normal permanganate solution is the smallest quantity capable of accelerating the reduction of mercuric chloride by ammonium oxalate. The reaction is retarded by mineral acids. Other oxidizing agents produce an accelerating effect. Thallic chloride behaves in a similar manner to mercuric chloride and is reduced to thallous chloride. The accelerating effect of oxidizing agents, the author supposes to be an alternating oxidation and reduction process.

On Some Isomeric Halogen Compounds of Thallium, and the Constitution of Double Salts. By Allerton S. Cushman. *Am. Chem. J.*, **24**, 222–242.—The salts of thallium of the empirical formulas TlX_3 and Tl_2X_3 (where X represents a halogen atom) are considered as double salts and may be accounted for by the theory of Blomstrand-Jörgensen as developed and extended by Remsen, or by the more recent theory of Werner. According to the older theory they can be represented by the formulas



Digitized by Google

According to Werner, on the other hand, we may consider the latter salt to have a dominant thallium atom at the center of an octahedron, and the former salt to have this atom at the center of a tetrahedron. On this hypothesis the two compounds may be represented by these formulas $(Tl'''X_6)3Tl$ and $(Tl'''X_4)Tl$. According to either of these theories it seemed possible to prepare isomeric double salts in which bromine atoms could be substituted for chlorine atoms, and *vice versa*. The author has prepared isomeric salts to which may be assigned the two formulas:

$$\begin{matrix} & Br—ClTl \\ Tl— & Br—ClTl \\ & Br—ClTl \end{matrix} \quad \text{and} \quad \begin{matrix} & Cl—BrTl \\ Tl— & Cl—BrTl \\ & Cl—BrTl \end{matrix}$$

The former which crystallizes in blood-red hexagonal crystals, is formed when thallous chloride suspended in a considerable quantity of hot water is treated with a hot solution of thallic bromide. The latter crystallizes out in orange-colored hexagonal plates when thallous bromide suspended in hot water is treated with a dilute solution of thallic chloride. The orange-colored isomer is very stable and can be crystallized unchanged from water; the other isomer is easily decomposed, and can be recrystallized only from its mother-liquor. An orange-colored salt of the formulae $TlCl.Br_2.3TlCl$ was prepared by treating moist thallous chloride with bromine. Silver nitrate precipitates from neutral solutions of the sesquichloride of thallium, a salt having the composition $12AgCl,Tl_2O_3.3H_2O$. In the presence of 10 per cent. of nitric acid, however, pure silver chloride can be precipitated. The question of the constitution of these double salts is still unsettled. The facts that these compounds are dissociated into thallous and thallic salts, that silver nitrate produces complete precipitation in the cold, and that platinic chloride forms with these precipitates of thallium chlorplatinate, the thallic portion remaining in solution, are arguments against the Werner theory. The conductivity experiments, on the other hand, are in its favor.

The Action of Caustic Hydroxides on Aluminium. By E. T. Allen and H. F. Rogers. *Am. Chem. J.*, **24**, 304–318—Aluminates of the alkali and alkaline earth-metals were produced by allowing the hydroxide to act upon metallic aluminium. They may be considered as derivatives of the hydroxides of aluminium. The aluminates, $Ca_3(AlO_3)_2$, $Ba_3(AlO_3)_2$, $Sr_3(AlO_3)_2$, may be considered as derivatives of $Al(OH)_3$; $Ba_2Al_2O_5$ and $Ca_2Al_2O_5$ as derivatives of $H_4Al_2O_5$; and $Ba(AlO_2)_2$, $Sr(AlO_2)_2$, $K_2(AlO_2)_2$, $Na_2(AlO_2)_2$, and $LiH(AlO_2)_2$ as derivatives of $HAlO_2$. The most soluble bases form the least stable aluminates. They

Digitized by Google

decompose with water, forming aluminium hydroxide which is crystalline or amorphous, according to the rapidity of the action. Lithium aluminate contains less base than the sodium and potassium salts, and is much more stable. The type of alkaline earth aluminate is dependent upon the relative proportions of metal, base and water.

Preparation of the Blue Oxide of Molybdenum and of Metallic Molybdenum. By ALLEN ROGERS AND F. H. MITCHELL. *J. Am. Chem. Soc.*, **22**, 350–351.—By adding stannous chloride to an acid solution of ammonium molybdate, a blue precipitate was obtained, which the authors suppose to be the oxide, Mo_3O_8, although no analysis is given to support this view, and none of its properties were studied. Metallic molybdenum was obtained in the electric furnace from the blue oxide, but nothing is said of its purity.

Cause of the Loss of Weight of Commercial Platinum when Heated Under Some Conditions. By ROBERT W. HALL. *J. Am. Chem. Soc.*, **22**, 494–501.—The conditions under which platinum loses weight were examined. The loss of weight is greatest in an oxidizing atmosphere. The variable weight of platinum is supposed to be due to the formation of a volatile oxide, stable at high and low temperatures.

Notes on Lead and Cadmium Ferrocyanides. By EDMUND H. MILLER AND HENRY FISHER. *J. Am. Chem. Soc.*, **22**, 537–543.—The precipitate produced by bringing together solutions of potassium ferrocyanide and lead acetate corresponds to the composition $Pb_2Fe(CN)_6$, when either solution is in excess. In the presence of acids, the composition of the precipitate varies. The composition of cadmium ferrocyanide has not been determined.

On the Universal Distribution of Titanium. By CHARLES BASKERVILLE. *J. Am. Chem. Soc.*, **21**, 1099–1101.—The ash obtained by incinerating fresh beef, beef bone, human flesh, and human bone has been examined for titanium, and found to contain the following amounts of TiO_2: beef bone, 0.0195 per cent.; beef flesh, 0.013 per cent.; human flesh, 0.0325 per cent.; human bone, a trace.

The Persulphates of Rubidium, Caesium, and Thallium. By HUGH MARSHALL. *J. Am. Chem. Soc.*, **22**, 48.—The persulphates of rubidium and caesium were prepared from the ammonium salt by double decomposition, and were found to be isomorphous with ammonium persulphate. Thallous persulphate has been prepared, but not in pure condition.

Digitized by Google

Atmospheric Ozone. By R. A. HATCHER AND H. V. ARNY. *Am. J. Pharm.*, 72, 423–429.—A preliminary report on the amount of ozone in the air at Covington, La.

Lithium Bicarbonate. By LYMAN F. KEBLER. *J. Am. Pharm.*, 72, 580–581.—Because several manufacturers have supplied an article by the above name, the author was led to examine some samples, and found them to be crystallized lithium carbonate.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Equipment of Metallurgical Laboratories. By H. M. HOWE. *Trans. Am. Inst. Min. Eng.*, 29, 721–728.—The author emphasizes the fact, that the main use of a metallurgical laboratory is to teach the principles, especially the chemical principles, which form the foundation of metallurgical practice, and that as soon as more stress is laid on laboratory work than to accomplish this end, it fails of its purpose, wastes the time of the student, and gives him wrong ideas. He advocates also the importance of small physical tests which do not require cumbersome apparatus and much material, and make clear many principles otherwise only imperfectly understood.

The Snyder Ore Sampler. *Editor Eng. Min. J.*, 70, 549.—The machine consists of a circular, shallow disk-shaped iron casting, mounted with the bottom to a horizontal revolving shaft having a fast and loose pulley. The casting has a sector-like slot. The ore to be sampled is discharged in a stream against the revolving disk; the sample passes through the slot into a bin back of the disk, while the rejected ore glides down in front into a second bin. The Gates Iron Works, Chicago, are the manufacturers.

The Temperatures at which Certain Ferrous and Calcic Silicates are Formed in Fusion, and the Effect upon These Temperatures of the Presence of Certain Metallic Oxides. By H. O. HOFMAN. *Trans. Am. Inst. Min. Eng.*, 29, 682–721.—In smelting non-ferrous metals, the slags made consist mainly of silica, ferrous oxide, and lime, the ferrous oxide being occasionally replaced more or less by manganous oxide, the lime by magnesia, baryta and zinc oxide and the silica and lime by alumina. The paper is a record of laboratory experiments carried out to obtain definite information on the formation temperatures of these slags which vary with the acidity and the character of the bases. The raw materials (SiO_2, $FeC_2O_4 + 2H_2O$, $MnCO_3$, $CaCO_3$, $MgCO_3$, $BaCO_3$, ZnO, Al_2O_3) were mixed in vary-

Digitized by Google

ing proportions, moistened with a 10 per cent. dextrine solution, molded to the same form as small-size Seger cones (three-sided pyramids, $\frac{3}{8}$ inch base, $\frac{3}{8}\frac{5}{2}$ inch high), dried and melted down on platinum foil in a Seger gas furnace, using Seger cones as pyrometers. While Seger cones are no true pyrometers, but rather pyroscopes, they form the most satisfactory means of studying the conditions under which a mechanical mixture is converted into a chemical compound. In the experiments, (1) the formation temperatures were determined for the subsilicates, $4RO.SiO_2$ and $3RO.SiO_2$; the singulo-silicate, $2RO.SiO_2$; the three-to-four silicate, $3RO.2SiO_2$; the sesquisilicate, $4RO.3SiO_2$; and the bisilicate $RO.SiO_2$. With each series the start was made with the pure ferrous silicate, and the iron gradually replaced by lime. (2) The formation temperatures were determined for a cross-series of slags, starting from the subsilicate, $4RO.SiO_2$, and extending to the trisilicate, $2RO.3SiO_2$, the percentage of ferrous oxide being kept twice that of calcium oxide, with the purpose of studying the effects of a steadily increasing percentage of silica. (3) A singulo-silicate, in which the percentages of silica, ferrous oxide and calcium oxide were most evenly divided (SiO_2, 3.21 ; FeO, 35.9 ; CaO, 32), was chosen, and the effects of replacing the constituents studied. The results may be summarized as follows: (1). The pure ferrous silicate of a slag always has a higher formation temperature than when part of the iron has been replaced by lime. After a certain replacement, however, the temperature rises again, more or less steadily, until a practical infusible mixture has been reached. Slags more acid than a singulo-silicate allow only a very much smaller substitution of lime with lowering of formation temperature, than when more basic. With the pure ferrous silicate, the formation temperature rises as the silicate degree falls.

(2) The cross series shows that the formation temperatures are partly constant from the silicate degree 0.50 to 1.25, that they then fall to a minimum with a silicate degree 2.50–2.75, and then rise quickly. (3) Manganous oxide raises the formation temperature approximately in proportion to the degree of replacement of ferrous oxide. Magnesia decidedly raises it when replacing lime ; zinc oxide sometimes raises, then again lowers it, the irregularity being due probably to the fact that the whole of the zinc oxide is not always converted into silicate ; baryta lowers the formation temperature decidedly and uniformly. A combination of magnesia and zinc oxide does not improve matters ; baryta added to magnesia or to zinc oxide lowers the temperatures and straightens out the curves, proving it to be a powerful flux. Alumina made to replace silica raises the formation temperature very quickly ; if it replaces lime, the temperature sinks somewhat and remains constant until three-quarters of the lime has

Digitized by Google

been thus replaced, when it rises quickly. Replacing ferrous oxide or ferrous oxide and lime by alumina gives irregular curves.

Utilizing the Heat of Molten Slag. By H. Lang. *Eng. Min. J.*, 70, 334.—This paper is a continuation of the discussion previously referred to (*this Rev.*, 6, 117).

A Decade of Progress in Reducing Costs. By C. Kirchhoff. *Trans. Am. Inst. Min. Eng.*, 29, 352–371.—The paper discusses the costs of producing pig iron, Bessemer ingots, rolling rods, coking, and lead smelting and refining, and shows what the causes were that have contributed to the reduction of cost.

The Smelting Corporation's Works at Ellesmere Port, England. By J. S. F. Vogel. *Eng. Min. J.*, 70, 365–366.—At these works, designed by W. B. Devereux, zinc-lead sulphide ores are roasted, briquetted, and then smelted in water-jacket blast-furnaces with sodium sulphate and iron oxides as fluxes according to the Fry patents. The slag has the following percentage composition: S, 14; SiO_2, 15; ZnO, 30; Fe, 22; CaO, 7; Na, 7, and small quantities of Pb, Mn, and Cu, and is thoroughly fluid. It runs off continuously at both ends of the blast-furnace into overflow slag-pots, while the lead is drained off through an Arents siphon tap.

Notes on Lead Smelting and Gold and Silver Refining, Cost of Smelting and Refining at the Globe Works, Denver, Colo. By M. W. Iles. *Eng. Min. J.*, 70, 185–186.—Sulphide ores are roasted in hand and mechanical reverberatory furnaces. At the Globe Works the cost of roasting in the hand reverberatory furnace was reduced from $3.975 per ton in 1887 to $2.620 in 1898. This saving in expense was due (1) to widening the hearths 2 ft. which allowed the addition of 200 lbs. to each ore charge and increased in twenty-four hours the output per furnace 1200 lbs., and (2) to a change in the method of working, the ore being withdrawn from near the fire-bridge in a sintered instead of in a fused state. Two Brown-O'Hara furnaces were put in operation but did not give the results expected from them. The total coast of roasting during the year 1898 was in the hand reverberatory furnace $2.75 (labor $1.50, coal $0.98, general expenses $0.77); in the Brown-O'Hara furnace $2.21 (labor $0.76, coal $0.62, general expenses $0.83). The author believes that the apparent gain of $0.54 with the mechanical furnace is more than offset by the expenses of repairs not accounted for in the above statement. The cost of smelting in the blast-furnace was reduced from $4.644 per ton of ore in 1887 to $2,260 in 1898. This was due to the increase of size of furnace, and of pressure of blast, and to the improve-

Digitized by Google

ments in the handling of ores and products. The cost of desilverizing of base bullion by the Parkes process showed a range of $3 to $5 per ton; the charges for interest, expressage of precious metal, brokerage, treatment of by-products, etc., make the total cost about twice as great.

Notes on Lead Smelting and Gold and Silver Refining. The Fallis Manometer. By M. W. Iles. *Eng. Min. J.*, **69**, 765–766.—For a description of this gauge the reader is referred to the original article containing complete drawings. M. W. Brown (*op cit.*, **70**, 93) calls attention to the fact that the Fallis manometer is a modification of an instrument invented many years ago by Dr. Wollaston (*Trans. North of England Inst. Min. Eng.*, **3**, 68; also *Trans. Inst. Min. Eng.*, **3**, 452).

Refinery Products. By M. W. Iles *School Mines Quart.*, **20**, 397.—The author publishes a list of forty-eight analyses and assays of refinery products, mostly from the works of the Globe Smelting and Refining Company, Denver, Colorado.

Welding Copper.—The Leibe Process. By C. E. Wait. *Eng. Min. J.*, **69**, 705.—The article records the results of some mechanical tests of welds made by the Leibe process of copper to copper, and copper to machine steel, the details of the mode of operating being withheld for the present.

New Smelting Works at Grand Forks, B. C. By A. W. B. Hodges. *Can. Min. Rev.*, **19**, 114–115.—The paper gives in outline a description of the "Granby" Copper Smelting Plant recently erected at Grand Forks.

Results of Smelting at the Hall Mines, Limited. By R. D. Headly. *Eng. Min. J.*, **70**, 214.—In the year ending September 30, 1899, the cost of matting sulphide copper ore was reduced from $3.66 per ton in the previous year to $2.96. This was due to the use of a larger blast-furnace. The cost was divided up as follows: flux, $0.196; fuel, $1.445 and labor, etc., $1.320. The matte averaged Cu, 45 per cent., Ag, 290 oz., and Au, 0.77 oz. per ton. The losses and gains in smelting were Au, + 10 per cent.; Ag, — 8 per cent.; Cu, — 6 per cent. In one of the reverberatory furnaces used for concentrating matte, the bottom, of 9-inch brick, had worn down in some places to 2½ inches. After tearing it out, it was found to contain 25 tons of copper, 20,000 oz. of silver, and 400 oz. of gold.

Testing Losses in Flue Dust in Cupola Furnace.—By N. P. Wood. *Min. Sci. Press*, **80**, 734.—J. B. Seager of the Helvetia Copper Co., Helvetia, Arizona, placed a sheet iron hood with

Digitized by Google

hopper over the stack of a copper blast-furnace in order to save flue dust. The hood reversing the direction of the gases before they are allowed to pass off into the open causes them to drop a large part of the dust which is collected in the hopper. The amount thus saved was 4.26 per cent. on the charge, and the value of copper in the dust to that in ore charge was as 2 : 3. A screen analysis gave the following results :

Size screen.		Per cent. caught.	Cu.	SiO_2.	Fe.	CaO.
On	20	0.5	none	...	...	...
"	40	16.3	3.8	37.0	11.4	21.5
"	60	31.8	3.9	35.2	13.2	22.7
"	80	13.1	4.2	38.2	15.0	20.0
"	100	5.7	4.5	40.7	14.4	19.0
Through	100	32.3	4.7	44.0	15.0	14.5

They show that the fine dust is richer in copper than the coarse parts. The furnace is run on oxide and sulphide copper ore with a small proportion of carbonate. With high-grade carbonate ore, the fine dust would form a larger proportion of the whole, and the loss in copper be correspondingly greater.

A Cheap Method of Converting Matte. By J. H. Rodda. *Eng. Min. J.*, 70, 123.—The method contemplates the use of the ordinary upright Bessemer converter. When turned into the horizontal position, it serves as fore-hearth for the blast-furnace receiving through an inlet at the side the matte-slag mixture, and settles out the matte while the slag overflows through the nose. When the converter is filled with matte, the side inlet is closed, and it is turned up and the matte blown in the usual way.

The Copper Queen Mine, Arizona. By J. Douglas. *Trans. Am. Inst. Min. Eng.*, 29, 511–546. Discussed by E. Keller. *Ibid.*, 1056–1058.—After a detailed description of the occurrence of the ore and a discussion of its genesis, the author takes up the metallurgical treatment. The smelting plant consists of four oval slightly conical water jacket blast-furnaces, 42 × 120 inches at the tuyeres; a furnace has two tilting wells, the slag from one overflowing into the other. The clean slag from the second well is caught in a 2-ton ladle which is moved by an electric crane and discharged into a 4-ton slag car drawn to the dump by a locomotive. The same crane transports the matte poured from whichever of the eight wells that is full, to one of the three converters and returns the converter slag to one of the wells nearest a furnace, thus giving shots of matte the necessary time for settling. The converters are of the horizontal barrel-type. They are 8 feet long, and 5 feet 6 inches in diameter. The blast-furnace puts through in twenty-four hours 160 tons of a charge made up of

Digitized by Google

oxide ore carrying some sulphur, low-grade clay-ore, and raw and roasted sulphide ore, so as to give a matte with 45 per cent. copper. Every tenth charge consists of briquettes made from fine ore-screenings, flue dust, and coke dust. Coarse screenings from the converters are added as extras. Acid and basic ores are so mixed that no flux is required. The coke consumption is 12.5 per cent., the coke containing 20 per cent. ash. The analysis of the ore charge shows: Cu, 9.1; SiO_2, 17.1; CaO, trace; S, 16.44; Fe, 29.7; Al, 5.4; Zn, trace; Pb, trace; Mn, 0.58; H_2O, 9.2 per cent.; Ag, 0.9 oz. per ton; Au, trace;—that of the slag: Cu, 0.6; SiO_2, 33.8; CaO, 1.11; S, 1.1; Fe, 37.7; Al, 13.15; Mn, 1.95 per cent.; Ag, trace. The converters are lined at the Bisbee works with a quartz-clay mixture carrying a small amount of copper; at the Morenci works an ore with 54 per cent. SiO_2 and 20 per cent. Al_2O_3 is used. The paper gives full details of four blows that a new converter lining will stand. It took nine hours forty-three minutes to make 15,070 lbs. of copper in 4 charges from 55 per cent. matte. From each charge samples were taken, 32 all together, and analyzed. The analysis of the samples taken from the last blow are subjoined. The values are all percentages except those in parentheses which represent the ounces of silver and gold per ton.

	Matte No. 25.	Slag poured No. 26.	Slag skimmings No. 27	White metal No. 28.	Copper No. 29.	Granul. slag rakings No. 30.	Hood No. 31.	Lining No. 32.
Silica.....	....	32.57	35.16	....	....	43.14	1.14	86.64
Copper	57.86	3.18	4.22	77.58	99.05	9.27	75.72	0.23
Iron.....	17.68	50.84	50.43	0.98	0.164	27.195	3.31	2.22
Nickel.....	0.22	0.19	1.34	0.13	0.024	0.912	0.26	....
Zinc.....	0.21	0.42	....	0.05	0.016	0.04	0.163	....
Lead	1.85	2.25	....	0.48	0.08	2.84	1.51	....
Antimony...	0.03	....	....	0.15	0.018	....	0.023	....
Arsenic	0.04	....	....	0.17	0.016	....	0.033	....
Selenium } Tellurium }	0.04	....	....	0.02	0.044	....	0.053	....
Sulphur	21.34	....	....	20.11	0.07	....	12.40	....
Silver.....	5.86	(0.16)	....	(7.86)	(12.78)	(0.52)	(7.50)	....
Gold.....	0.12	....	....	(0.18)	(0.27)	....	(0.10)	....
Insol. resid..	0.39	....	....	....	....	....	....	....
Aluminum ..	....	....	....	....	....	....	0.22	3.71

Keller, calculating the elimination of impurities in Bessemerizing from the author's analyses, gives the following percentages: S, 99.2 per cent.; Fe, 99.6 per cent.; Zn, 93.8 per cent.; Ni, 93.1 per cent.; Pb, 96.2 per cent.; Sb, 70.6 per cent.; As, 79.5 per cent.; Se and Te, 35 per cent. In analyzing some samples obtained from the author, and separating selenium and tellurium, he found the elimination of selenium to be greater than that of tellurium. In the analyses of the author, nickel and cobalt are

Digitized by Google

given together as nickel; Keller separated nickel and cobalt and found that cobalt formed 25–50 per cent. of the sum of the two metals. As cobalt is completely slagged in Bessemerizing, the elimination of nickel as 93.1 per cent. calculated from the author's figures is very much too high.

Steam Metal. By E. S. Sperry. *Aluminum World*, **6**, 91–92. *The Foundry*, **16**, 106–108.—Steam metal is an alloy of copper, tin, zinc and lead used for valves, cocks, injectors, couplings, unions, etc. If correctly made, it is strong, but not brittle, not easily corroded, and permits being worked at a high speed. A good all-round alloy contains Cu, 85 per cent.; Sn, 7 per cent.; Zn, 5 per cent.; and Pb, 3 per cent. Copper alone, while resisting corrosion, would be too soft and tough; it is therefore hardened by the addition of tin; this, however, makes unsatisfactory sand castings and zinc has to be added. Finally, in order to permit the alloy to be cut at a high speed, lead is added, but only a small quantity, as an excess would reduce the resistance to corrosion. The small amounts (under 1 per cent.) of chemically combined iron found in steam metal have no harmful effect; they perhaps make the alloy slightly harder. Any mechanically combined iron, however, becomes hardened in casting, and ruins the tools when the alloy is being cut. This iron gets into the metal from chips, pieces of tools, etc., contaminating the scrap from which steam goods are invariably made.

Emerson's Method of Producing Electrolytic Copper-Wire Bars. By E. Emerson. *Eng. Min. J.*, **70**, 399.—In this process a spiral strip of copper is deposited by electrolysis on a cathode using unrefined copper as anode; this strip is removed and suspended in another electrolyzing vat as cathode, and the deposition continued until a bar of sufficient size has been produced.

The Hans A. Frasch Electrolytic Process for Extracting Metals as Applied to Copper-Nickel Matte. By J. Struthers, *Eng. Min. J.*, **70**, 272–273. Discussed by W. Thum. *Ibid.*, 334.—The process consists of electrolyzing in a divided cell sodium chloride with nickel-copper matte as anode. The chlorine set free at the anode is to dissolve the metal, while the sodium is to form caustic soda as a valuable by-product. From the solution of metal chlorides, the metals are to be precipitated by electrolytic or by chemical methods. Thum's objections relate to the difficulty of making electric connection with anode particles that have become covered with sulphur, and of depositing copper and nickel from the chloride solution.

Notes on the Disintegration of an Alloy of Nickel and Aluminum. By E. S. Sperry. *Trans. Am. Inst. Min. Eng.*,

Digitized by Google

29, 280. DISCUSSED BY A. E. HUNT AND S. PETERS. *Ibid.*, 1029–1030.—The author found that an alloy of equal parts of nickel and aluminium in about one month showed cracks on the surface, these slowly penetrated deeper, new cracks began to appear, the alloy split into many large pieces, and after three months had become entirely disintegrated, forming a coarse powder. The newly made alloy was very fluid, had a gray color like that of wrought iron and the fracture did not have any crystalline appearance. An alloy of 90 per cent. aluminum and 10 per cent. nickel remained sound. Hunt's observations agree with those of the author; he found that the same phenomena occurred with 50 per cent. of alloys of aluminum with iron, or manganese, or chromium, or tin. Peters observed in the early seventies in making ferromanganese with 80–85 per cent. manganese in a crucible, that after a lapse of some time the alloy crumbled to a fine powder, an odor of hydrocarbon being given off.

The Bryan Mill as a Crusher and Amalgamator Compared with the Stamp-Battery. BY E. A. H. TAYS. *Trans. Am. Inst. Min. Eng.*, 29, 776–782. DISCUSSED BY A. H. WYNNE. *Ibid.*, 1054–1056.—This paper gives the results obtained in amalgamating the same kind of gold ore in a 4-foot Bryan mill and a 5-stamp battery. A 4-foot Bryan mill costs about the same as a 5-stamp battery, but crushes about twice the amount of ore. The extraction of gold is about the same with both apparatus, but the battery saves 65 per cent. of the values inside the mortar, while only 33 per cent. is collected inside the Bryan mill. The Bryan mill requires less attention than the battery and the wear of iron is smaller. By reason of the higher cost of the castings used by the Bryan mill, the cost of wear is nearly three times greater than with the battery. In the discussion, Wynne states that in order to do satisfactory work with a roller mill, it is necessary to work with fluid and not with a soft-hard amalgam as is the case in battery amalgamation. He believes that if the author had used enough quicksilver, the saving in silver would have been nearer 80 per cent. than 33 per cent. The experience of others with this mill seems to prove that it is necessary to run with a hard amalgam, as was apparently done by Tays, because a very liquid amalgam would not remain in the mill.

The Patio Process in Guanajuato, Mexico. BY R. FERNANDEZ. *Trans. Am. Inst. Min. Eng.*, 29, 116–121.—The ores best suited for the patio process are those containing the silver in the form of argentite, then follow pyrargyrite, polybasite, stephanite, proustite, etc. Chlorides, bromides, and iodides of silver are considered to be refractory; blende, galena, bournonite, and pyritic

Digitized by Google

ores are not suited at all. High-grade ores do not give as satisfactory results as those containing 40–50 oz. silver per ton. The ores at this celebrated mine are crushed in a roller-mill to pea-size, then ground in an arrastra to pass an 80-mesh screen, and amalgamated in the patio. The amalgam is separated from the sands in a settler, retorted, melted, and assayed. The wet pulp to be treated in one operation amounts to 100–250 tons. It is spread in the patio to the thickness of 12 inches. It should contain enough water to dissolve the salt and blue vitriol (40–60 kilos per ton) which are added, and thick enough to hold finely divided mercury (8 parts to one part silver) in suspension. The amalgamation lasts three to six weeks according to the time of the year. The progress of the operation is ascertained by panning some of the pulp, collecting the amalgam, volatilizing the quicksilver, and weighing the residual impure silver. Occasionally assays are made of the tailings. The treatment is considered to be at an end when the ratio of silver and mercury in the amalgam is the same as at the beginning of the amalgamation, allowing for loss of mercury 1.116 parts for 1 part silver, of which 1 part is chemical and 0.116 mechanical. The reactions that take place in the patio have been much discussed. Starting with cupric chloride formed by the action of sodium chloride upon cupric sulphate, they may be expressed according to R. Fernandez as follows :

$$2CuCl_2 + 2Ag_2S = Cu_2Cl_2 + 2Ag_2Cl + S_2$$
$$2Ag_2Cl + 2Hg = Hg_2Cl_2 + Ag_2$$

and

$$Cu_2Cl_2 + 2Ag_2S = 2CuS + 2Ag_2Cl$$
$$2Ag_2Cl + 2Hg = Hg_2Cl_2 + Ag_2.$$

A detailed statement of cost of treatment is given by the author : the total cost is $13.45 per ton ; the loss in silver is 6.25 per cent.; the consumption of blue vitriol 4 kilos, and of salt 55.5 kilos per ton.

The Evolution of the 300-Stamp Mill on Douglas Island, Alaska. By H. Watson. *Min. Sci. Press*, **80**, 668.—This is a brief description of the celebrated gold mill which crushes per day 1300 tons of ore, assaying $3.00 gold per ton and containing 2 per cent. concentrates which are saved on belt machines. The tailings run usually from 10–15 cents per ton.

Cheap Mining and Milling at Spanish Mine. By H. F. Brown. *Min. Sci. Press*, **80**, 318.—The paper gives a brief description of the occurrence of gold and manner of working in this well-known mine where the ore yielding a trifle over 91 cents per ton, gives a profit of 32.6 cents, the cost of 58.5 cents being divided into mining, 34.6 cents, and milling, including general expenses, 23.9 cents.

Digitized by Google

Gold Mining and Milling in Georgia. By H. V. Croll. *Min. Sci. Press*, **80**, 121–122.—This is a brief review of the past and present methods of working with special reference to the Dahlonega district, Lumpkin County.

Note on Plate-Amalgamation. By A. J. Clark. *Trans. Am. Inst. Min. Eng.*, **29**, 459–462. Discussed by Collins and Furman. *Ibid.*, 1039–1042. Referring to a paper by Bayliss on "The Accumulation of Amalgam on Copper Plates" (*op. cit.*, **26**, 33), in which it was stated that at the Drumlummon mill, Marysville, Mont., the silver of the ore showed a tendency to escape amalgamation, the amalgam nearest the battery being richest in gold, and that farthest from it richest in silver, the author records one set of tests he made in 1897 with samples of amalgam taken from the Golden Star mill of the Homestake Mining Co., Lead City, S. Dak., the results of which were similar to those of Bayliss; and a second set made in 1899 from the entire product of the plates of four batteries which wholly contradicted those from the first set of tests. He believes that an amalgamated copper plate has a weaker amalgamating power for silver than one that has been silverplated.

Digitized by Google

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 2.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

Some Observations on Practice of Cyanide Process at Mercur, Utah. By W. MAGENAU. *Min. Sci. Press*, **80**, 433–464, 492.—The ores of the Mercur district are well suited for the cyanide process; they run from $3.00 to $12.00 in gold, and carry some silver; some large ore bodies contain from $1.00 to $2.50 gold, but with less than $2.50 gold per ton they can, at present, not be worked at a profit. The ores are of four kinds: (1) "Oxidized Ore," forming two-thirds of the ore milled, consists of ferruginous shale, siliceous limestone and decomposed porphyry. It frequently contains cinnabar. (2) "Base Ore," constituting one-fourth of the milling ore, resembles the oxidized ore as far as the rock is concerned, but carries realgar, orpiment, and stibnite, and sometimes native antimony, further arsenopyrite. (3) "Talcy Ore," of minor importance, is a compact clay (decomposed porphyry) which has to be calcined before it can be leached. (4) "Black Ore," dull black from carbonaceous matter, carrying good values, but not worked at present. The paper discusses only the treatment of oxidized ore, the manner of working the other ores having been described by H. L. J. Warren (*this Rev.*, **6**, 49). A peculiarity of the work is the coarse-crushing previous to leaching, 1- and 2-mesh sieves being common, the De Lamar mill only having found it necessary to use a 4-mesh screen. The explanation given for the coarse-crushing is that the gold occurs chiefly along minute lines of fracture into which the solutions penetrate readily. The machinery consists of gyratory crushers, rolls, and screens. The crushed ore, mixed with burnt lime, if necessary, is discharged into leaching tanks of 16–250 tons capacity. The common size holds 30–50 tons of ore, is circular and has sheet-iron sides and 3-inch red wood bottoms; the De Lamar

Digitized by Google

mill has 250-ton vats. The filter in common use is a single thickness of burlap laid on strips, nailed to the bottom, and protected by a second row of strips (at right angles to the first) from the shovels, when the tailings are being discharged; the filtrate is somewhat turbid, but less so than would be expected from the percentage of slimes in the charge. Only one strength of solution is used, being admitted sometimes from above, sometimes from below. The total time required for the leaching of a charge is sixty to one hundred and twenty hours. It is made up of a number of separate percolations, the solvent being every time drained off. In a given time, a large number of short percolations gives better results than a few of longer duration. The first percolation lasts about eight hours, the others less time. It has been noticed that the gold is rendered soluble after a few hours' contact with the cyanide, and that the bulk of the time is required to wash out the gold solution from the ore. The amount of wash-water used is generally equal to the amount of moisture remaining in the drained ore. The extraction from ore with $3.00 to $5.00 gold per ton ranges from 70–80 per cent., the ordinary variations being 72–76 per cent.; with ores assaying over $5.00 gold per ton the extraction is normally above 80 per cent.; with base ores after roasting, 90 per cent. and over. The gold is precipitated from the solutions (carrying when rich, $3.00 to $4.00, when poor $0.60 to $1.00 gold per ton) with zinc shavings or zinc dust. The shavings are made of No. 30 sheet zinc, 50 sheets at 12 lbs. forming a "cake." Six sheets at a time are wound around a wooden mandrel (5 inches in diameter), tied with cord and then cut in a screw-cutting machine; the tool ("self-tempering steel") is held by the automatic carriage and cuts the shavings from one end. A mandrel geared to 50 revolutions per minute and cutting to $\frac{1}{1000}$ inch makes 50 lbs. shavings in eight hours. The space taken up by the zinc in the precipitating box is 1 cubic foot for every 3½ tons of ore in twenty-four hours. The precipitation with zinc-dust has already been described (*this Rev.*, 6, 49). The gold precipitate contains less than 6 per cent. gold. This is due to the settling out of the slimes from the turbid filtrates of the leaching tanks and to the presence of disintegrated particles of zinc. The precipitate is separated from the undecomposed shavings by screening with sieves ranging from 4- to 10-mesh; they are then dried, sampled, and shipped to a lead smelting plant. Refining at the works by treatment with sulphuric acid and nitric acid under a hood, provided with a suction fan to carry off poisonous gases, is carried on at one mill only. The following two analyses give an idea of how greatly the percentage composition of samples of slimes varies.

Digitized by Google

	Au.	Ag.	Al_2O_3 and Fe_2O_3.	Ca.	Mg.	Zn as metal.	ZnO.	Pb.	As.	Hg.	SiO_2.	Other elements.
I	4.56	0.05	3.00	3.20	0.07	38.28	35.86	1.20	0.25	0.10	6.10	7.58
II	5.26	trace	0.92	2.78	0.48	55.38	16.66	0.53	0.71	0.31	2.12	14.85

The subjoined analysis shows the composition of the solids of a working solution: Zn, 0.062; Ca, 0.005; Mg, 0.0009; Fe, trace; SO_3, 0.102; K_4FeCy_6, 0.0002; KCyS, 0.0015; Cy, 0.092; K, 0.1000; total, 0.27 per cent.

There are in the district two mills (Northern Light and Chloride Point) treating silver ores with potassium cyanide. The ores contain 2–20 ozs. silver per ton; the mode of operating i similar to that of the gold mills. The solutions contain abou 100 times as much metal as those in the gold mills; the extraction is 60–70 per cent.

The Cyanide Process at Mercur. By D. C. Jackling. *Min. Sci. Press*, **80**, 582–609.—This paper treats of the process carried out at the Golden Gate Mill which has a capacity of about 800 tons calcined and roasted, and 200 tons raw ore. The ores are classed as "oxidized ores," a calcareous and silicious variety, "talcy ores," a decomposed porphyry, and "base ores" calcareous and talcose rock with large quantities of base-metal sulphides. The ore is crushed to pass a 2-inch ring; it then passes through a mechanical drying furnace which discharges it into Berthelet screens, to separate out the fines. The coarse part goes through roughing rolls ($\frac{1}{2}$ inch apart), and after the fines produced have been taken out by sieves, to finishing rolls. The finished oxidized ore will pass a 3-mesh screen (No. 16 wire) and is ready to be leached; the talcose ore passing a 4-mesh screen (No. 15 wire) is calcined in a Jackling furnace (see *this Rev.* **6**, 47). The base ore, finer than an 8-mesh screen (No. 16 wire), containing 2–5 per cent. sulphur and 1–2½ per cent. arsenic, is roasted in the same furnace, the sulphur being reduced to 0.75 per cent. and the arsenic to 0.10 per cent. The high percentage of sulphur is due to the formation of calcium sulphate. The main difficulty to be encountered is that, in the peroxidation of the iron of the pyrite and arsenopyrite by raising the temperature, the ore is liable to sinter which interferes with the subsequent leaching. In calcining, the talcy ore is fed so as to lie 6 inches deep on the hearth, the rabbles traveling somewhat more quickly than in roasting base ores (40 ft. per min.); the ore remains six hours in the furnace and 140 tons are put through in twenty-four hours. In roasting base ores, the ore lies 4 inches deep, remains eight hours in the furnace, and 65 tons are worked in twenty-four hours. Careful investigation has shown that there is no volatilization — loss of gold in roasting and a very small loss by dusting. The oblong leaching tanks (size not given) must be large, as 1 tank has in the bottom eight discharge

Digitized by Google

gates, 15 inches in diameter, through which the tailings are shoveled into trucks standing beneath. Gravel filters are used. They consist of a framework of wooden strips (1 x 4 inches, set on edge, 5 inches apart and held by two 1 x 4 inch blocks, nailed fast 18 inches apart) 4 inches deep, filled 2 inches with ¾-inch, 1 inch with ½-inch and 1 inch with coarse sand. The three layers are separated by two pieces of 12-ounce burlap and the top is covered with 16-ounce burlap and this is protected by iron strips against injury in shoveling out the tailings. The top 16-ounce burlap has to be renewed once a year, the underlying 12-ounce burlap once in two years; the top layer of sand has then also to be replaced, on account of its having become somewhat clogged by slimes. In leaching, the first solution (under a head of 14 feet), containing 0.4–0.5 per cent. potassium cyanide, is admitted from below; it reaches the surface in about eight hours when sufficient solution is run in from the top to cover the charge to a depth of 2 inches. It is allowed to stand sixteen hours, is then drawn off and at the same time fresh solution turned on; the leaching by percolation lasts about 48 hours. This solution is followed by a weaker solution, 0.30–0.35 per cent. potassium cyanide for 48–72 hours (the time required being determined by assays made on samples taken from the ore), and then washed and drained in twenty-four hours. The time required for leaching is five to six days, and the total time between charges is six to seven days. All solutions are run into storage tanks; with strong working solutions (0.45 per cent. potassium cyanide) the storage-tank solution will contain 0.33–0.35 per cent. potassium cyanide. The rate of leaching is ¾–1 inch per hour; with base ores, this rate drops to ¼–⅛ inch. The best ratio of solution and wash-water to ore is as 2:1. In leaching roasted ores having a gange of argillaceous and silicious limestones it happens that the ore comes to a set (cement) which retards the percolation of the solvent. The consumption of cyanide is 0.9 lb. per ton of ore, 0.45 lb. being consumed when the strong solution is being applied; the rest is mostly lost by imperfect washing. The low solution is made alkaline by the addition of caustic soda (1 lb. soda to 1 ton solution) before it is brought up to the standard with solid potassium cyanide. This effects a saving of 1 pound of cyanide for every pound of caustic added. The gold is precipitated by means of imported zinc dust containing about 90 per cent. metallic zinc. A tank with a capacity of 30 tons of solution is half-filled, air at 10–15 lbs. pressure is forced in through a ½-inch pipe to act as a stirrer, 5 lbs. of zinc dust are sifted into the tank while the tank is filling, and the sifting is finished when the tank is filled. The air hose is now removed, the suspended matter allowed to settle for half an hour and the supernatant liquor drawn off through the side, 8 inches above

Digitized by Google

the bottom, and passed through a filter press to collect any suspended gold slimes. With a head of 18 feet no other pressure is required unless the filters (Canton cloth) are filled with slimes. The precipitated solutions assay about 20 cents gold per ton. In the monthly clean-up, the precipitating tanks are drained and the slimes are passed through the presses. The slimes are then dried in iron pans placed in cast-iron muffles and the filter-cloths burned; the whole is then pulverized to pass a ¼-inch screen. The pulverized mass containing 2½-3 ounces gold per pound is treated with sulphuric acid to which some nitric acid has been added, care being taken to remove the fumes. The residue, after being washed in a filter press and dried, contains 60 per cent. gold and 40 per cent. slimes; it is pulverized, fluxed with soda, potash, and borax, and melted in a No. 300 plumbago crucible in a double oil-burning furnace large enough to hold two crucibles. The bullion, 950 fine, is cast into 1000-ounce bars. The cost of refining is 15 cents per ounce of gold.

Successful Precipitation from Solutions Weak in Cyanide. By M. W. ALDERSON. *Min. Sci. Press.*, **80**, 316–317.—The author gives further evidence of the value of his practice (*this Rev.*, **6**, 50) of adding some fresh potassium cyanide to the head-compartment of a zinc box in order to make the zinc active as a precipitant, and furnishes a new explanation of the manner in which this addition acts. In his first experiments he found that the solution, strengthened by the addition of fresh salt, dissolved the crusts that had formed with the ordinary weak working solution and concluded that this was its sole effect. Following, however, Christy's reasoning (*this Rev.*, **3**, 144) upon experiments on the precipitation of gold from cyanide solutions, he believes that the effect of the addition of potassium cyanide is to dissolve the film which is liable to form on the surface of the zinc and hinder the galvanic precipitation, either by preventing contact or by setting up a counter electromotive force. Gold is satisfactorily precipitated from dilute cyanide solutions as long as the zinc remains active. This addition of fresh salt becomes necessary at intervals when the activity of the zinc begins to decrease. The salt is not, as might be thought, disseminated quickly through the entire solution, but is taken up gradually, though it had all been dissolved. As far as his present experience goes, the author advises to add solid cyanide every six hours—with a new plant one pound cyanide per ton of solution; later, half a pound and even less will be found to be necessary.

Precipitation in Cyaniding. By M. W. ALDERSON. *Min. Sci. Press*, **81**, 124.—The author attacks the statement frequently made that from a cyanide solution at 90° F. better results are ob-

Digitized by Google

tained in precipitating with zinc than at ordinary temperature. In his experience he obtained as good results at 32° F. as at 120° F. He also does not accept the statement that the precipitation of the gold is at present connected with any difficulty, and cites a number of examples with the necessary references to substantiate his own experience by that of others.

"Wet Crushing and Cyaniding the Silicious Ores of the Black Hills, South Dakota," and "Some Further Mill Practice in Cyaniding the Silicious Ores of the Black Hills, South Dakota." By J. M. HENTON. *Min. Sci. Press*, **80**, 261; **81**, 284.—The Dakota Mining and Milling Co., of Central City, S. D., treats the silicious ore west of Deadwood by wet-stamping with a stock solution of potassium cyanide as battery water. The results have, on the whole, been very satisfactory. The gold in the ore is present in such a fine state of division as not to be readily amalgamated. It is crushed through a 6-mesh woven screen, a low discharge being used. Of the pulp, 18 per cent. remains on a 20-mesh screen, 12.6 per cent. on a 40-mesh, 7.4 per cent. on an 80-mesh, 7.4 per cent. on a 100-mesh, and 49.4 per cent. is finer than a 100-mesh screen. The pulp coming from the battery is run into a wooden tank (16 feet in diameter and 7 feet high) having an Alderson agitator (*this Rev.*, **6**, 50), and the overflow is collected in a sump to be pumped into the storage tank of the battery. When sufficient pulp has collected in the tank, the battery is stopped and the agitator started, enough potassium cyanide having been added to bring the solution to the most efficient strength. Agitation lasts about three hours, stock solution is run in and made to overflow so as to carry off the slimes which are settled in a tank large enough to hold what is formed in a few days' run. The sands are run into an ordinary leaching vat and are treated there by percolation in the usual way. The gold solution is precipitated by shavings in a zinc box, 13 x 2 x 2½ feet, a zinc compartment being 30 inches long, 18 inches deep, and 15 inches wide. Only four compartments were found to be necessary, the rate of flow being about one ton per hour. The zinc boxes are cleaned up once a week. It will benoted that there is no gold-solution tank between the settling vat and precipitation box to hold back any slimes that may pass along. This may make it necessary to clean up the boxes oftener than once a week. An improvement on the old arrangement is the insertion of a "V" box to settle out the sands which are then discharged into the agitating tank.

The paper concludes with some experiments on the assay on cyanide solutions. These were evaporated in the gold pan in various ways with and without litharge, and in a lead tray. The

Digitized by Google

results show that all these methods give approximately concordant results. The following table will show the conditions of the solutions and the precipitation during the month of January, 1900. Columns I and II contain the values in dollars of the solution entering and leaving the zinc box ; column III, the pounds of KCN per ton ; and column IV the percentage alkalinity in terms of H_2SO_4 :

I.	II.	III.	IV.
$3.30	$0.00	1.1	0.3
2.80	0.00	1.7	0.55
3.10	0.40	2.0	0.5
2.80	0.30	1.3	0.45
2.80	0.15	1.8	0.7
2.70	0.05	2.0	0.6
2.70	trace	1.9	0.45
3.00	0.15	2.0	0.5
3.20	0.35	2.4	0.85
2.40	0.20	2.4	0.75
2.60	0.05	2.3	0.65
4.10	0.15	2.4	0.5
3.20	1.70	2.9	1.00
3.80	0.15	2.1	0.4
3.90	0.10	2.0	0.7
4.80	0.50	2.2	0.55
4.20	0.40	1.5	0.4
4.00	0.50	2.5	0.5
3.50	0.15	2.2	0.4
4.60	0.30	1.4	0.25
4.00	0.20	2.1	0.3

The Cyanide Works of the Liberty Bell Gold Mining Co., Colorado. By F. L. Bosqui. *Eng. Min. J.*, 70, 337–338.— The successful treatment of the ore of this mine is connected with many difficulties, especially as the silver is present in a form that is not readily amalgamated. Until recently the method of working (see Winslow, *Trans. Am. Inst. Min. Eng.*, 29, 296) consisted in plate amalgamation, followed by concentration on Wilfley tables. As the extraction amounted to only 50 per cent. of the combined values of gold and silver, treatment with potassium cyanide was tried, and this proved so satisfactory that a 240-ton cyanide plant was erected. The only difficulty encountered was the slimy character of the tailings, which made filtering difficult. The leaching room, 190 by 44 feet, has a double tier of leaching vats, five to a tier, each 33 feet inside diameter and 8 feet deep, holding 275 tons tailings. The precipitating room, 135 by 30 feet, holds two storage tanks (20 feet in diameter and 15 feet deep), four zinc precipitation boxes, two vacuum cylinders connected with a 7 x 10 Stilwell-Bierce and Smith-Vaile vacuum pump, two Gould rotary pumps for raising solution, and a clean-up plant consisting of a 2 x 7 feet redwood acid tank, a double

Digitized by Google

plunger Johnson pump, and a 12-compartment Johnson filter-press with two sump tanks, each 15½ feet in diameter and 6 feet deep. The tailings from the Wilfley tables are run from a common center in radiating launders to the upper or collecting vats (on grades ranging from 2.2 to 4 per cent.), being fed by revolving pipe-distributors. The slimes are carried off by means of overflow-gates, of which there are four to a vat. By this arrangement a charge is obtained of which about 45 per cent. will pass a 100-mesh screen and can be satisfactorily leached, while the slimy overflow, about 25 per cent. of the whole, is so fine that less than 1 per cent. will remain on a 150-mesh screen. From the upper or collecting tanks the pulp is shoveled through bottom-discharge doors into the leaching tanks below (5 men discharging a tank in ten hours at a cost of 6 cents per ton). From the lower tanks the tailings, after treatment, are removed by sluicing. They assay 0.07–0.10 oz. gold and 2–2.5 ozs. silver per ton. The cost of treatment for three months is shown in the following table. The item of chemicals includes cyanide, lime, sulphuric acid, and zinc:

	May.	June.	July.
Labor	$0.318	$0.235	$0.255
Chemicals	0.973	0.390	0.371
Assaying	0.044	0.030	0.043
Shipping bullion	0.009	0.001	0.001
Taxes, insurance, and depreciation	0.212	0.101	0.135
Miscellaneous	0.018	0.004	0.008
Totals	$1.574	$0.761	$0.813

When the plant is worked to its full capacity the cost will be reduced to $0.55 per ton.

The Treatment of Low Grade Silicious Ore of the Rossland Camp, by Cyanide of Potassium. By G. V. Hopkins. *Can. Min. Rev.*, 19, 131–134.—The process used at this mill is that of Pelatan-Clerici which aims to combine lixiviation with amalgamation assisted by electricity. While it has been a failure wherever else it has been tried, it is stated to have been successful here. From a solution worth $4.00 gold per ton, the values are said to have been reduced in six hours to $0.07, the current being of 70–80 amperes at 5–7 volts. The paper gives full drawings of the plant and interesting details as to the method of working.

Telluride Ores and the Treatment of Them. By T. A. Rickard. *Eng. Min. J.*, 70, 93–94.—Considerable difficulty has been encountered in treating the telluride unoxidized gold ores of the Great Boulder Main Reef, Kalgoorie, Western Australia. They have been overcome by Skewes and Marriner by grinding the

Digitized by Google

roasted ores in pans, previous to leaching with potassium cyanide, and allowing the tailings to run over amalgamated copper plates to save the coarse gold. In roasting tellurides, the tellurous oxide formed combines readily with ferric oxide, forming tellurite of iron which is liable to coat the particles of gold and make them non-amalgamable. The extraction is 96 per cent. on ores and 93–98 per cent. on tailings, and the cost of treatment $4.75 a ton.

The Real Fuel Ratio. By S. C. Jewett. *Foundry*, **16**, 208–209.—The author calls attention to the wrong custom of judging the work of a cupola solely by the amount of fuel that is consumed. He shows, *e. g.*, how different the temperature of the metal must be when a few heavy castings are to be poured from large ladles from that when small castings are made from small ladles. In the former case the metal need not be so hot as in the latter and the cupola will require less fuel.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. Talbot, Reviewer.

The Relative Values of the Mitscherlich and Hydrofluoric Acid Methods for the Determination of Ferrous Iron. By W. F. Hillebrand and H. N. Stokes. *J. Am. Chem. Soc.*, **22**, 625–630.—In the presence of sulphides the Mitscherlich method yields high results as a consequence of the oxidation of these compounds at the expense of the sulphuric acid used for decomposition, or at the expense of ferric compounds present. The error from this source seems to be negligible under the conditions of the hydrofluoric acid procedure, unless the proportion of pyrite in the mineral is very large.

Estimation of Pyrrhotite in Pyrite Ores. By F. B. Carpenter. *J. Am. Chem. Soc.*, **22**, 634–637.—Determinations are made of total sulphur and of silicon by the usual methods. A portion of the ore is treated with concentrated hydrochloric acid, water, and alcohol, then dried at 100°, and weighed. This weight, less that of the silica, is assumed to represent FeS_2. After deducting the sulphur corresponding to this FeS_2 from the total sulphur, the pyrrhotite (Fe_7S_8) corresponding to the residual sulphur is calculated.

On the Determination of Phosphoric Acid as Phosphomolybdic Anhydride. By H. Sherman and Henry St. John Hyde. *J. Am. Chem. Soc.*, **22**, 652–658.—A neutral solution of ammo-

Digitized by Google

nium molybdate is added, drop by drop, to the nitric acid solution of the phosphate (of definite acidity), the temperature being maintained at 50°. The precipitate is filtered on a Gooch crucible, which, after the washing of the precipitate, is placed in a nickel crucible and the latter is heated to dull redness for fifteen minutes. The residue is $P_2O_5.24MoO_3$. The procedure appears not to be influenced by the presence of the salts commonly occurring in the course of phosphate analyses, with the possible exception of ammonium chloride.

A New Volumetric Method for the Estimation of Copper. By S. W. Parr. *J. Am. Chem. Soc.*, **22**, 685–689.—The copper-bearing material is dissolved in nitric acid in slight excess, the copper is reduced by sulphurous acid and precipitated by potassium thiocyanate. The cuprous thiocyanate is filtered on an asbestos felt, which, with the precipitate, is treated with sodium hydroxide and standard potassium permanganate solution until the yellow of the solution gives place to a brown or green. Dilute sulphuric acid is then added in excess, and the titration completed to the usual end-point, with permanganate. The reaction is

$$10CuCNS + 14KMnO_4 + 21H_2SO_4 = 7K_2SO_4 + 14MnSO_4 + 10HCN + 10CuSO_4 + 16H_2O.$$

A Method of Determining Free Alkali in Soaps. By R. E. Divine. *J. Am. Chem. Soc.*, **22**, 693–695.—The soap is treated with an excess of stearic acid in alcoholic solution, and the excess is measured by standard alkali solution. The amount of the acid neutralized by the soap is taken as a measure of the total free alkali. Another portion is treated with alcohol, this solution mixed with one of barium chloride, and titrated with stearic acid, and the amount thus used is taken as a measure of the free caustic alkali. The carbonate is determined by difference.

Free Arsenious Oxide in Paris Green. By E. W. Hilgard. *J. Am. Chem. Soc.*, **22**, 690–693.—The importance of a microscopical examination is urged, and the author points out what, in his opinion, are the weak points in the procedure adopted, notably by Eastern experiment stations, for the detection of arsenious oxide in Paris green.

Note: The Analysis of Arsenical Insecticides. By J. K. Haywood. *J. Am. Chem. Soc.*, **22**, 705–706.—The author finds that some copper oxide passes into solution when 1 gram of Paris green is treated with 500 cc. of water. He concludes that the Paris green is partially decomposed. Compare preceding abstract and *this Rev.*, **6**, 149.

Digitized by Google

Determination of Carbon in Ferrochrome. By A. A. Blair. *J. Am. Chem. Soc.*, **22**, 719–723.—An apparatus is described for the decomposition of the ferrochrome by means of acid sulphate, and the treatment of the products of the reaction. Reference should be made to the drawings with the original article.

The Separation of Tungsten Trioxide from Molybdenum Trioxide. By Max J. Ruegenberg and Edgar F. Smith. *J. Am. Chem. Soc.*, **22**, 772–773.—The separation is made by means of sulphuric acid of a specific gravity of 1.378, in which the tungsten trioxide is insoluble. The presence of considerable quantities of iron do not affect the solubility of the tungsten oxide.

A Method for the Rapid Determination of Carbon in Steel. By Robert Job and Charles T. Davies. *J. Am. Chem. Soc.*, **22**, 791–797.—The authors have studied the methods for the determination of carbon with the idea of still further reducing the apparatus and procedure to the simplest form consistent with accuracy. Reference should be made to the cuts and details in the original paper.

Determination of Iron in Magnetite Ore by the Specific Gravity Test. By Joseph W. Richards. *J. Am. Chem. Soc.*, **22**, 797–798.—Magnetite ores which are mixtures of magnetite and quartz can be examined (using relatively large weights) by the aid of a gravity balance with a resulting maximum error of 0.1 and often only 0.02 or 0.03 in the gravity as determined, corresponding to variations of 1 to 3 per cent. in iron. A table is appended showing percentages of iron for gravities from 2.66 to 5.18.

Irregular Distribution of Sulphur in Pig Iron. By Randolph Bolling. *J. Am. Chem. Soc.*, **22**, 798–799.—In the opinion of the author, the sample pig should be drilled entirely through for the determination of sulphur, owing to varying distribution of that element throughout the casting.

Aluminum as an Electrode. By George J. Hough. *J. Am. Chem. Soc.*, **20**, 302–303.—The author finds that aluminum can be substituted for platinum as the cathode in copper determinations.

Silica and Insoluble Residue in Portland Cement. By P. W. Shimer. *J. Am. Chem. Soc.*, **21**, 289–291.—If the cement is decomposed by acids, and the residue, after dehydration, is ignited and weighed but not treated with hydrofluoric acid, the percentage results may be materially too high with cements which have not been properly compounded and burned. The difference between the percentages found by this procedure and those found

Digitized by Google

after fusion of the cement, are, in general, an index of the care used in its manufacture.

Separation of Metallic Sulphides by Means of Hydrochloric Acid. By J. Bird Moyer. *J. Am. Chem. Soc.*, **21**, 642–645.—The following separations were accomplished by heating the sulphides in an atmosphere of hydrochloric acid : lead from arsenic, lead from antimony, lead from bismuth, cadmium from arsenic, silver from arsenic.

F. J. Moore, Reviewer.

Comparative Accuracy of Titrimetric and Gasometric Methods of Estimating Hydrogen Dioxide in Presence of Various Preservative Agents. By Carl E. Smith. *Am. J. Pharm.*, **70**, 225–234.—The author tests four methods for the determination of hydrogen peroxide: (1) direct titration of the solution with permanganate in acid solution ; (2) application of the same reaction, measuring the liberated oxygen ; (3) oxidation with sodium hypochlorite and measurement of the gas evolved ; (4) oxidation with potassium chlorate in the presence of potassium iodide, and titration of the liberated iodine by means of thiosulphate solution. He finds the first method accurate, but not applicable in the presence of organic preservatives like glycerine. The last method is recommended in all such cases. The author does not favor either of the gasometric methods.

A New Volumetric Method for the Determination of Silver. By Launcelot W. Andrews. *Am. Chem. J.*, **24**, 256–266.—In Pisano's method for the determination of silver, a solution of starch iodide is run into the silver solution in the presence of suspended calcium carbonate. The author finds that strict proportionality does not exist between the amount of silver present and the iodine used. Addition of the starch iodide to an acid solution makes this discrepancy greater and does not yield a satisfactory end-point. It is believed that the following reaction takes place in the solution : $AgNO_3 + I_2 = AgI + INO_3$. The existence of the compound INO_3 is assumed to explain the behavior of the solution during titration, as it shows marked oxidizing properties. It is found that if a little of a ferrous salt or nitrous acid is added to the solution, much better results are obtained. The ferrous solution does not act upon the starch iodide provided an equivalent amount of ferric iron is also present. With these changes the method yields a satisfactory end-point, and is especially recommended for the determination of small amounts of silver, though a correction for dilution is necessary. The author suggests the use of a starch iodide solution for all uses to which a standard iodine solution is usually put, claiming that it is more

Digitized by Google

permanent and that it does away with the necessity of frequently preparing a starch indicator. Full directions for the preparation of such a solution are given.

A New Method for the Determination of Aluminium. By E. T. Allen and V. H. Gottschalk. *Am. Chem. J.*, **24**, 292–304.—Few precipitates offer so many inconveniences in manipulation as aluminum hydroxide, especially when it is free from iron. The gelatinous precipitate settles slowly, clogs the filter, is difficult to wash, and is apt to run through the filter. These considerations led the authors to look for an insoluble compound of aluminum which should be crystalline. Such a compound was found in the basic carbonate. This is easy to filter and entirely insoluble. Unfortunately it holds back a certain amount of fixed alkali, which cannot be removed by washing. This renders its direct weighing impracticable. It was found, however, that this compound, on being boiled with water, reverts to the hydrate, and that the hydroxide thus formed was much easier to filter and wash than that prepared in the ordinary way. Upon these facts the authors base a method which may be outlined as follows: The solution containing aluminum is nearly neutralized with ammonia. A stick of potash whose silica content is known is then dissolved in water, and the solution cautiously run in from a burette until the precipitate first formed redissolves, a large excess being undesirable. This solution is then precipitated with a current of carbon dioxide, and the precipitate is filtered and washed. The filter is pierced and the precipitate washed back into the beaker in which the original precipitation was made and boiled two or three minutes with water containing ammonium salts, then again filtered, washed, ignited, and weighed in the usual manner. The authors claim a considerable gain in time over the ordinary method. The presence of iron does not affect the results. The fact that the method is inapplicable in the presence of the alkaline earth metals must seriously limit its usefulness.

On the Separation of Nickel and Cobalt by Hydrochloric Acid. By Franke Stuart Havens. *Am. J. Sci.*, **156**, 396–398. Pinerùa (*Gazz. chim. ital.*, **27**, 56) has recently published a method for separating nickel and cobalt, based upon the fact that cobalt chloride is soluble in ether which has been saturated with hydrochloric acid, while nickel chloride is insoluble. The author has repeated this work and finds that under the conditions stated by Pinerùa the nickel chloride is not entirely insoluble. By reducing the amount of water present to a minimum he is able to avoid this difficulty, but even then the process is available for separation only when very small amounts of cobalt are

Digitized by Google

concerned. Larger quantities are invariably held back by the insoluble nickel chloride.

The Application of Iodine in the Analysis of Alkalies and Acids. By CLAUDE F. WALKER AND DAVID H. M. GILLESPIE. *Am. J. Sci.*, **156**, 455–462.—Phelps (*this Rev.*, **2**, 67) has shown that when barium hydroxide is boiled with an excess of iodine, the following reaction takes place:

$$6Ba(OH)_2 + 12I = BaIO_3 + 5BaI_2 + 6H_2O.$$

After the excess of iodine has been boiled off, the solution is acidified and the liberated iodine titrated with the thiosulphate solution in the usual way. The authors find that the same method can be successfully applied to potassium hydroxide, but that it is not applicable in the case of sodium carbonate. They modify the method of Phelps in a few manipulatory details.

The Action of Carbon Dioxide upon Soluble Borates. By LOUIS CLEVELAND JONES. *Am. J. Sci.*, **155**, 442–446.—Morse and Burton (*Am. Chem. J.*, **10**, 154) have suggested the following method for the determination of boric acid: To the alcoholic solution containing the boric acid a known excess of barium hydroxide is added over and above what is necessary to form barium metaborate. Carbon dioxide is then passed in to change the excess of barium hydroxide to carbonate, and the whole evaporated to dryness and ignited to constant weight. From this weight the amount of boric acid can be obtained by an indirect calculation. The success of this method depends on the correctness of the assumption that only the barium hydroxide is affected by the carbonic acid, and not the metaborate. The author finds that this is by no means the case. On the contrary, he finds that it is possible, by means of carbonic acid, to decompose practically all of the barium metaborate and volatilize all the boric acid with alcohol. He finds that it is impossible to verify the results of Morse and Burton by any variation of procedure.

A Technical Scheme for the Rapid Determination of Small Amounts of Copper in Chilled Slags. By CHARLES F. SHELBY. *Eng. Min. J.*, **69**, 708.—The slag is dissolved in aqua regia, evaporated and heated to dehydrate silica. After re-solution and removal of the silica, sodium thiosulphate is added to reduce the iron. Boiling with a little metallic zinc now precipitates the copper as sulphide. The latter is filtered off and determined by the cyanide or iodide method.

The Rapid Determination of Copper and Nickel in Sulphide Ores and Matte. By TITUS ULKE. *Eng. Min. J.*, **70**, 303.—The crushed ore is treated successively with hydrochloric and

Digitized by Google

nitric acids, and the nitrates formed finally dissolved in water and the solution filtered. A little more nitric acid is added and the copper removed by electrolysis, a current of 0.2 to 0.3 amp. being used. The solution is now oxidized by means of hydrogen peroxide, and the iron removed by three precipitations with a large excess of ammonia. The combined filtrates are evaporated to about 200 cc., more ammonia added, and the solution electrolyzed hot by a current of 2 to 3 amp. Iron anodes must be used, as the solution attacks platinum and the deposited nickel then becomes contaminated with it.

The Titration of Mercury by Sodium Thiosulphate. By JOHN T. NORTON, JR. *Am. J. Sci.*, **160**, 48–56.—Scherer (Lehrbuch der Chemie) has suggested that mercurous nitrate, mercuric nitrate, and mercuric chloride can all be titrated directly by means of sodium thiosulphate, Hg_2S, $2Hg_2S,HgNO_3$, and $2Hg_2S,HgCl$ being the products formed in each case. These methods have been incorporated by Sutton in his "Volumetric Analysis." According to his statements, satisfactory results should be expected with each of these methods except the last. The author finds all three very unsatisfactory, but succeeds in getting good results by maintaining rigidly certain fixed conditions of temperature and dilution. The most radical of his modification is the use of an excess of the thiosulphate, the excess being determined by titration with iodine.

The Statement of Rock Analyses. By HENRY S. WASHINGTON. *Am. J. Sci.*, **160**, 59–63.—The importance to petrographers of a uniform order in the statement of rock analyses is emphasized. It is suggested that the following order be observed: SiO_2, Al_2O_3, Fe_2O_3, FeO, MgO, Na_2O, K_2O, H_2O by ignition, H_2O at 110°, CO_2, TiO_2, ZrO_2, P_2O_5, SO_3, Cl, F, S (FeS_2), Cr_2O_3, NiO, CoO, MnO, BaO, SrO, Li_2O.

A Rapid Method of Determining Lime in Blast Furnace Slags. By TITUS ULKE. *Eng. Min. J.*, **69**, 164.—The slag is dissolved in nitric acid. After removal of barium by means of sulphuric acid, ammonia is cautiously added until the solution becomes dark red, but not enough of it is added to precipitate any of the iron. A liberal excess of solid ammonium oxalate is now added and the solution boiled. The precipitate of calcium oxalate is rapidly filtered and washed, and finally titrated by permanganate.

The Colorimetric Assays of Copper. By GEORGE C. HEATH. *Eng. Min. J.*, **70**, 364.—This paper consists of a polemical discussion of the subject.

Digitized by Google

The Analysis of Uranium and Vanadium Ores. By OLIVER P. FRITCHLE. *Eng. Min. J.*, **70**, 548.—This method is especially applicable to the analysis of the mineral carnotite, a hydrous potassium uranium vanadate. The ore is treated with nitric acid, and the solution is boiled with sodium carbonate and an excess of 20 per cent. sodium hydroxide. This precipitates the iron and uranium, the vanadium being held in solution by excess of alkali. The precipitate is dissolved in nitric acid and the solution heated with ammonia and ammonium carbonate. This precipitates the iron, which is filtered off and eventually titrated with permanganate. The uranium solution is treated with sulphuric acid and evaporated till white fumes appear. After dilution the uranium is reduced by the addition of scraps of metallic aluminum, and the solution titrated with permanganate. For vanadium it is best to dissolve another sample in nitric acid, to add sulphuric acid, expel the nitric acid, reduce with aluminum, and titrate uranium, iron, and vanadium together by permanganate. The permanganate required for the iron and uranium is then deducted.

Note on the Ferrocyanide Titration of Zinc. By EDWARD H. MILLER AND E. J. HALL. *School Mines Quart.*, **21**, 267.—The authors study the effect of the presence of several salts upon the results of this method, and sum up their results as follows: "(1) The amount to be subtracted as shown by a blank test is often greater than the excess required in an actual titration. (2) Salts such as calcium chloride, and sodium citrate, and acids, notably hydrochloric acid, retard the end reaction by their solvent action on uranium ferrocyanide. (3) Ammonium chloride, not exceeding ten grams, does not interfere with the accuracy of the method, but has some (unknown) effect on the zinc ferrocyanide. (4) The presence of considerable quantities of aluminum sulphate, such as would be present if copper were removed by aluminum foil, renders the results unreliable. (5) Six cubic centimeters of concentrated hydrochloric acid is sufficient to prevent any interference of lead. (6) Antimony gives high results, while small amounts of bismuth have no influence."

The Analysis of Slags and Cinders. Part I: Lead and Copper Slags. By C. H. JOÜET. *School Mines Quart.*, **22**, 64–74.—This article contains a detailed scheme for the determination of those constituents of slags whose estimation is required in practical furnace work. Any adequate condensation is impracticable.

The Estimation of Copper in Ores by the Modified Cyanide Process. By O. H. PACKER. *Min. Sci. Press*, **81**, 312.—This article makes no claim to originality. It gives detailed directions adapted to the use of those who are not "expert chemists."

Digitized by Google

PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

The Assay of Fluid Extract of Belladonna. BY W. A. PUCKNER. *Pharm. Rev.*, **16**, 303–308.—In adapting Keller's method for the assay of alkaloidal drugs to the assay of fluid extracts the extract is either dried upon sawdust or else it is shaken with a definite quantity of the solvent and an aliquot portion of the latter taken for the further assay. The first method is tedious, and in the second, serious error may be introduced in the removal of the aliquot portion. The author avoids the evaporation of the fluid extract and extracts the alkaloid from the entire quantity of fluid used by repeated extractions of the ammoniacal solution with small quantities of chloroform. From the chloroform it is extracted by successive portions of one per cent. hydrochloric acid, and from this solution it is again removed by extraction with chloroform and ammonia. The solution is evaporated to dryness and the alkaloidal content of the residue determined by titration with twentieth-normal acid.

The Assay of Belladonna Leaves. BY W. A. PUCKNER. *Pharm. Rev.*, **16**, 180–183.—Ten grams of the powdered drug are shaken with 50 cc. of chloroform-ether mixture and 5 cc. of ten per cent. ammonia water. The solution is subjected to percolation and the alkaloids determined volumetrically by means of twentieth-normal acid as in the method in ordinary use.

The Quantitative Estimation of Carvone in Volatile Oils. BY F. W. ALDEN AND S. NOLTE. *Pharm. Archives*, **2**, 81–91.—Since several chemists have reported adversely on the method proposed for the estimation of carvone as carvoxime, the previous work (*Pharm. Rev.*, **14**, 76) was repeated and the conditions more fully studied. The conditions were widely varied and the results were on the whole satisfactory.

On the Volumetric Estimation of Methyl Salicylate. BY EDWARD KREMERS AND MARTHA M. JAMES. *Pharm. Rev.*, **16**, 130–133.—About 5 grams of methyl salicylate are saponified in sodium hydroxide, care being taken to use at least 7 molecules of sodium hydroxide to 1 of the ester. The solution is diluted to 500 cc. and 10 cc. are transferred to a flask and heated to about 60°. An excess of $\frac{1}{10}$-normal iodine is added, the flask shaken, the solution cooled, diluted to 500 cc., and filtered. In an aliquot part of the filtrate the excess of iodine is determined by titration with $\frac{1}{10}$-normal sodium thiosulphate.

The Detection of Salicylic Acid in Foods. BY F. A. GENTH, JR. *J. Franklin Inst.*, **145**, 228–229.—A number of preserves

Digitized by Google

have been tested for salicylic acid by "pulping" with phosphoric acid, straining, distilling, and testing portions of the distillate with ferric chloride. In a number of cases where the sample was known to be free from added preservative a color reaction was obtained similar to that given by salicylic acid. The color in dilute solutions was violet, in more concentrated solutions reddish. The nature of the distillate and of the process is being studied.

Diastasimetry. By DAVID L. DAVOLL. *Pharm. Archives*, 1, 73–85.—The author discusses the question of the conversion of starch by diastase and gives the results of a study of diastasimetry based upon the iodine reaction, in which both the kind of starch and the strength of the iodine solution have been considered and the amount of reducing substances present at the "end-reaction" has been determined.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. CROSBY, REVIEWER.

Granites of Southern Rhode Island and Connecticut with Observations on Atlantic Coast Granites in General. By J. F. KEMP. *Bull. Geol. Soc. Am.*, 10, 361–382.—All the granites described are biotite granites, muscovite, though present, being very subordinate and hornblende failing entirely. The following types are recognized: Westerly gray, Westerly red, Stony Creek red, Stony Creek gray, and Lyme pink. The petrographic descriptions of these types and of the contact phenomena and basic inclusions as well as of the associated aplite and pegmatite, are followed by a discussion of the chemical composition based upon six analyses, four of which are new. The silica is quite uniform, varying from 68.40 to 73.05, but with only one below 70 per cent. The Rhode Island granites run somewhat higher in lime than the Connecticut granites. The magnesia is very low in nearly every case. The soda in relation to the potash is relatively high in some types and low in others, while one, the red granite of Stony Creek, proves to be one of the purest potash granites on record. The paper closes with a general review of the granites of the Atlantic sea board, which are believed to belong to several different geological periods and among which the biotite granites largely predominate.

Igneous Complex of Magnet Cove, Arkansas. By HENRY S. WASHINGTON. *Bull. Geol. Soc. Am.*, 11, 389–416.—This paper is an able and timely review, in the light of the modern ideas of magmatic differentiation, of the limited and isolated area of plutonic rocks so carefully mapped and described by J. F. Williams

Digitized by Google

ten years ago. The scope of the paper is clearly and tersely indicated in the author's summary, from which the reviewer quotes. The structure of the complex is briefly described, and from the evidence of its broadly elliptical outline, relations to surrounding shales, the presence of an overlying zone of metamorphosed rocks, the arrangement and serial petrographical and chemical characters of the main types, together with other minor points, it is shown that the igneous complex is probably a laccolith, and certainly a unit or integral mass of intruded magma. The component abyssal types are not due to successive injections as was suggested by Williams, but are the products of a differentiation in situ of the originally homogeneous mass of intruded magma ("laccolithic differentiation" of Brögger). The main rock types are briefly described, some new analyses being given; and they are shown to form a regularly graded series, ranging from foyaite, through leucite-porphyry, shonkinitic syenite, normal ijolite, and biotite ijolite to jacupirangite. This serial and common genetic character is shown both mineralogically and chemically. It is probable that the dikes of tinguaite and nepheline-porphyry are aschistic (undifferentiated injections of the still fluid differential zones into the surrounding rocks), while those of the monchiquitic rocks are diaschistic (products of a still further differentiation of these zones). The arrangement of the abyssal rocks is abnormal and differs radically from most other cases of differentiated masses, in that there is progressive increase in acidity toward the periphery, the analogous case at Umptek in Kola being especially mentioned. An explanation of this, based on a process of fractional crystallization or freezing of the magma, which is regarded as a solution, the solvent crystallizing first, is given, and the hypothesis is applied to other cases. It is suggested that all laccoliths and similar masses of magma may be referred to at least four different types, dependent on the chemical composition of the magma as a whole, the differences between which would be satisfactorily accounted for by the hypothesis. In the opinion of the reviewer, the explanation of this contrast between the normal centripetal acidity and the abnormal centrifugal acidity of plutonic masses might be strengthened and simplified by recognition of the important rôle as a solvent of water, which, so far as known, is universally present in magmas, and is the one important constituent which never freezes.

Contact Metamorphism of a Basic Igneous Rock. By Ulysses Sherman Grant. *Bull. Geol. Soc. Am.*, 11, 503–510.—The rock referred to is the Keweenawan gabbro, occupying a roughly crescentric area of about 1,000 square miles in the northeast corner of Minnesota, between Lake Superior and the Canadian boundary. The contact phenomena are described only for

Digitized by Google

the northwestern border of the gabbro, which the author regards as probably intrusive, where it lies upon the Archaean, Keewatian and, especially, the quartzite, iron-bearing series, carbonaceous slate and graywacke slate of the Animikie. The metamorphism is very noticeable, and consists of a partial or complete recrystallization of the adjacent rocks. Complete recrystallization is the rule near the contact, and in places this extends 500 feet from the contact; while a partial recrystallization is at times noticeable for two or three times this distance from the present margin of the gabbro. The rather normal metamorphic characters of the slaty members of the Animikie are first briefly noticed, and then the specially interesting contact phenomena of the iron-bearing series are more fully described. The original rock is regarded as having been a glauconitic green sand, in which there was more or less iron carbonate. This rock has been widely altered by regional metamorphism to a quartz-magnetite-amphibole slate commonly known as actinolite schist, which has in turn been profoundly changed by the gabbro, the resulting rock being a coarse-grained aggregate of quartz, magnetite, olivine, or fayalite, hypersthene, augite, hornblende, etc. The derivation of all these minerals, including those like olivine, augite, and hypersthene, which are characteristic of basic, igneous rocks, and rarely found in metamorphosed sediments, from the actinolite schist, is shown to be possible; and the proofs that this contact zone really belongs to the Animikie and not to the gabbro are summarized. The contact phenomena of the Keewatin are said to vary greatly, with biotite as a prominent feature. In the Archaean, the acid rocks or granites have escaped sensible metamorphism, while the basic rocks or greenstones, including gabbros, diabases, and diorites, have been profoundly altered, and usually in a way to make them difficult to distinguish from the gabbro itself.

A Granite-Gneiss Area in Central Connecticut. By Lewis G. Westgate. *J. Geol.*, **7**, 638–654.—This is purely a petrographic paper, describing an elliptical area of gneissoid granite on the Connecticut river east of Middletown. The phenomena and inclusions of the enclosing schists prove the granite to be intrusive, in spite of the marked and persistent foliation. It assumes frequently the character of an "augen"-gneiss. Basic segregations or schlieren of dark color and fine grain are a common feature, strengthening the proof of an igneous origin, as do the associated dikes of pegmatite and the contact zone of granulite. The component minerals, from which the chemical composition may be approximately deduced, are chiefly quartz, various feldspars and biotite, the feldspars including most abundantly orthoclase with an acid plagioclase and subordinate microcline. The accessories include titanite and a very little apatite and magnetite. In the granulite, garnet is the chief or only accessory.

Digitized by Google

Suggestions Regarding the Classification of the Igneous Rocks. By WILLIAM H. HOBBS. *J. Geol.*, **8**, 1–31.—After noting the importance of adapting the classification to the needs of the field geologist as well as the petrologist, the bearing of recent petrographical studies on rock classification, the definition of a rock as an object rather than as an integral part of the earth's crust, the importance of texture as a basis of classification, the need of combining chemical and mineralogical classifications as a basis for rock classification and of substituting quantitative for qualitative analyses, that rock relationships should be indicated by the combination of names into a binomial, or, if necessary, a polynomial nomenclature, the author introduces graphical methods as essential to a comprehensive study of rock analyses. The system of diagrams proposed by Brögger for this purpose is preferred. In these are set off on radius vectors the amounts of the eight principal chemical constituents reckoned in molecular ratios, ferrous and ferric iron being entered upon the same radius vector, and silica, because so much in excess of the others, being evenly divided between the two horizontal radius vectors. A broken line joining the intercepts on the eight radius vectors forms a polygon, which may be long and narrow, or short and thick, convex above or below, or reentrant in any portion, left- or right-handed, etc., according to the chemical constitution of the rock. When viewed in this diagram the rock comes to have a handwriting by which it may be instantly recognized ; and when drawn to scale the diagram not only shows the chemical character of the rock but all the results of analysis may be read from it numerically. The main purpose of this paper is to adapt the Brögger diagram to represent, not merely an individual analysis, but a rock species or type covering a considerable range of differing analyses. In other words, composite diagrams are proposed, each representing the average of a group of analyses. Examples are given for the principal types of plutonic and volcanic rocks. The possibilities of the method are farther illustrated by grouping the diagrams in natural series, which show progressive changes in form ; and also by introducing a composite of each series. The numerous analyses upon which the diagrams are based are quoted in tabular form.

The Nomenclature of Feldspathic Granolites. By H. W. TURNER. *J. Geol.*, **8**, 105–111.—Accepting the principle that the classification of granular rocks, if not of lavas, should be based on mineral composition, the author notes that this is equivalent to a classification based on molecular composition, in so far as the minerals are composed each of one kind of molecules. But plagioclase is an exception, since it is composed of two kinds of molecules in ever varying proportions. The author proposes that the

Digitized by Google

molecular classification be applied throughout ; and hence, in calculating the composition of the feldspathic rocks the plagioclase should be resolved into the constituent albite and anorthite molecules, and the name plagioclase should not be used. This is shown to be particularly necessary with the monzonites and diorites, which contain both orthoclase and plagioclase, since the plagioclase may vary from a basic labradorite to an acid oligoclase, thus giving rocks which could not properly be designated by the same name. It is suggested, therefore, that if we subdivide the feldspathic rocks on the basis of the ratio of the alkali-feldspar molecules (Or + Ab) to the lime-feldspar molecules (An) the true mineral and chemical relations of the rocks will be brought out and a better classification result. A graphic illustration is given in tables showing percentages of the alkalies and lime and the ratios of Or + Ab to An for the principal feldspathic types. The author further suggests the use of mineralogical terms in naming granolites of simple composition, as orthosite for a rock composed chiefly of orthoclase, albitite, for one composed chiefly of albite, etc. ; the names of other essential constituents to be used in substantive forms, as quartz-orthosite or granite, and of accessory constituents in adjective form, as quartziferous syenite, etc.

The Origin of Nitrates in Cavern Earths. By William H. Hess. *J. Geol.*, **8**, 129–134.—The nitrates are not derived from the excrement of bats, as popularly supposed, but have their origin in the oxidation or nitrification of organic matter in the surface soil through the agency of bacteria, and the subsequent leaching of the nitrates so formed downward into caverns, where they slowly accumulate with other salts as the water escapes by evaporation. This explanation is in harmony with the fact that bats penetrate but short distances from the entrance to a cavern, while the distribution of the nitrates is entirely without reference to the entrance, the cavern earth of the Mammoth Cave having been worked for nitrates for a distance of over five miles from the only opening to the surface. Three analyses show that nitrates form but a small part of the soluble salts of the cavern earth, which include also sulphates and chlorides, and may aggregate as much as 13 per cent. The general conclusion as to the origin and source of the nitrates is sustained by a comparison of analyses of the soluble portions of (1) subsoil from the surface above the Mammoth Cave, (2) cavern earth from the subjacent part of the cave, (3) bat guano, and, (4) cavern earth immediately below the bat guano. A comparison of bulk analyses of bat guano and cavern earth follows ; and it is suggested that the calcium phosphate of the latter cannot be referred to the former, since the insolubility of this salt makes it a necessary residuary product of the solution of limestone. Analyses show that the water drip-

Digitized by Google

ping from the roofs of caves is not markedly different from ordinary subdrainage waters. The nitrates and other soluble salts accumulate only in the earths of relatively dry caverns, or where the inflow of water does not exceed in amount the water removed by evaporation; and numerous analyses show that all dry caves contain nitrous earths. Nitrates found under overhanging cliffs are of a similar origin—evaporation of water which has percolated through the soil; and essentially the same explanation will fit the case where nitrates accumulate on the surface of a manure heap, through the joint action of capillary attraction and evaporation.

The Calcareous Concretions of Kettle Point, Lambton County, Ontario. By REGINALD A. DALY. *J. Geol.*, **8**, 135–150.—The concretions occur in a horizontally bedded, fissile, black, bituminous shale of middle Devonian age. They are approximately spherical, one to three feet in diameter, and possess a radial crystalline structure. An analysis of one of the concretions shows 88.42 per cent. of calcium carbonate, only 2.99 per cent. of magnesium carbonate, and the remainder consists of iron oxide, insoluble residue, hydrocarbons, and water. The most remarkable feature is the mechanical displacement and deformation of the enclosing shales which the growth of the concretions has involved. The pressure or "live force" of the growing concretion or aggregate of spherically radiating crystals has even been sufficient to induce a true slaty cleavage in the shale at some points. The main thesis of the author is to demonstrate that this great centrifugal pressure is compatible with the persistence of the capillary film investing the growing crystal or concretion and without which its continued growth would be impossible. The explanation, which, it would seem, must be generally accepted, is based upon the experiments of Jamin, leading to the conclusion that equilibrium may exist between two unequal pressures affecting the ends of a capillary tube, provided a column of liquid occupying the tube be interrupted by bubbles of air. The presence of the latter excites capillary attraction which is so strong as to take up several atmospheres of pressure applied at one end of the tube. The force so expended is represented in the compression of the air bubbles, and in changing the form of the air menisci; surface tension is thus overcome. The movement of the bubbles progressively decreases in the direction of the greater pressure until one is reached which is not disturbed at all so long as the pressure remains constant. The bubbles act like so many buffers. Any capillary tube filled with water interrupted by any insoluble gas or liquid possessing a lower surface tension than water, will exhibit the same phenomenon.

The Granitic Rocks of the Pikes Peak Quadrangle. By EDWARD B. MATHEWS. *J. Geol.*, **8**, 214–240.—The granites

Digitized by Google

are regarded as of late Algonkian age; and four types are recognized, differing markedly in texture but agreeing closely in mineral and chemical composition. They are typical biotite granites, in which hornblende rarely occurs; and a mechanical analysis of the coarse Pikes Peak type gave: quartz, 33.4 per cent.; microcline, 53.3; biotite and all minerals with specific gravity above 3.0, 10.7; and oligoclase, 2.6; total, 100 00. The petrographic descriptions are accompanied by tables showing for the different types the relative abundance of the sixteen component minerals, and the relative size and development of the three essential constituents. Strangely enough, fluorite, which occurs in three of the four types and is very marked in the Summit type, is not mentioned as a constituent of the Cripple Creek type, notwithstanding its prominence as a feature of the Cripple Creek ore deposits. Another table gives the chemical composition of all but the Cripple Creek type, in four of Hillebraud's complete and careful analyses, with determinations of seventeen constituents. When the individual analyses and their average are reduced to molecular proportions and compared with analyses of other granites, the Pikes Peak granites are seen to be exceptionally rich in silica and potassium, as well as in fluorine; and the family likeness of these types suggests their origin in a common magma relatively rich in the elements named. Although this tends to make the relative ages of the types of little moment, it may be noted that on page 223 the Pikes Peak type is described as clearly the oldest; while on page 228 this distinction is assigned to the Summit type. The reviewer's observations in this field suggest the advisability of regarding the Pikes Peak type as the normal granite of the batholite; the Summit type and the Cripple Creek types as representing a once-continuous contact zone of the batholite in which the remnants of the Algonkian cover now chiefly occur; and the fine-grained type, which occurs only as dikes in the other types, representing residual magma intrusive in shrinkage and other cracks. According to this view the contact-zone types are the oldest and the fine-grained or dike types the youngest, while the Pikes Peak or normal type is intermediate, having solidified after the contact zone by which it is covered and before the dikes by which both it and the contact zone are intersected. As might be expected, the gneissoid phase is chiefly characteristic of the outer or border portions of the massif.

Igneous Rock-Series and Mixed Rocks. By Alfred Harker. *J. Geol.*, **8**, 389–399.—A rock-series is defined as an assemblage of rock-types, with a certain community of characters, associated in the same district, belonging to the same suite of eruptions and holding a similar position in the scheme of igneous rocks belonging to that suite. According to the differentiation hypothesis,

Digitized by Google

they are derivatives of the same order from one common source, resulting from differentiation along similar lines and to the same degree. The fundamental characteristics of such a series, having regard to chemical composition, are of two kinds: (1) Those belonging to the individual rock-types and shared by all the types included in the series; and (2) those belonging to the assemblage of types as a whole, depending upon variations in the composition of the members as compared with one another. These characteristics admit of very clear graphic presentation. For this purpose the method of two equal rectangular coordinates first used by Iddings is recommended, silica being referred to one axis and bases to the other; and the resulting curves are briefly discussed. The origin of igneous rocks by admixture rather than by differentiation is next considered, and three principal cases are distinguished: (1) Mixture of two fluid magmas; (2) permeation of a solid rock by a fluid magma; and (3) inclusion of rock fragments in a fluid magma. The second and third cases are practically limited to igneous rocks of cognate origin; and the distinction of the included and permeated rocks or xenoliths as accidental and cognate is regarded as important, the latter only yielding by their absorption new rocks of any considerable extent or importance. Several cases are considered, including the admixture of two rocks of the same rock-series, and the solution by a magma of extraneous quartz, and of limestone. The admixture of the extreme types of a series will not, in general, give exactly any of the intermediate types. The rock analyses of Clarke and Hillebrand are cited in illustration of this principle; and it is pointed out that mixtures, even of two normal igneous rocks and still more of an igneous and a sedimentary rock, must often be abnormal in chemical composition. The relations of the chemical composition of the magma and of foreign admixtures to the mineralogical composition are also considered.

A Contribution to the Natural History of Marl. By CHARLES A. DAVIS. *J. Geol.*, **8**, 485–497. This valuable contribution to the chemistry of marl is based upon observations made in certain small lakes in Michigan; but the principles which it embodies undoubtedly admit of general application. The marl is nearly pure carbonate of lime, the source of which is to be sought in the solution by meteoric waters of limestones or other calcareous strata, the drift of limestone districts and, more remotely, the carbonation of lime-bearing silicates. The real problem is the deposition of this dissolved carbonate of lime in the form of white, chalky marl, which consists only to a small extent of shells or fragments of shells. After pointing out the inadequacy of animal life, evaporation and escape of carbon dioxide on relief of pressure, as causes of the precipitation of the carbonate of lime, the

Digitized by Google

author discusses at length the only alternative hypothesis, namely, that the calcium salts are precipitated through the agency of plant life. In the marly lakes aquatic plants of all kinds become incrusted with calcium carbonate, which is not a true secretion of the plants, for it is purely external, and the same species in other districts are not incrusted. The deposit is formed incidentally by chemical precipitation upon the surface of the plants, probably only upon the green parts, and in performance of normal and usual processes of the plant organism. All green plants inhale carbon dioxide and exhale oxygen; and these are two possible causes of the calcareous incrustation. If the calcium carbonate is in excess in the water, and is held in solution by carbon dioxide, then the absorption of the latter by the plants causes precipitation of the carbonate upon the parts (stems and leaves) abstracting the gas. But if the proportion of calcium carbonate in solution is so small that it would not be deposited even if there were no carbon dioxide present, the precipitation is explained by the action of the oxygen set free by the living plants in converting calcium bicarbonate to monocarbonate: $CaH_2(CO_3)_2 + O = H_2O + CaCO_3 + CO_2 + O$.

Plants vary greatly in their power of precipitating the calcium carbonate; and the algae, and especially the Characes or Stoneworts, are most efficient. Analyses are given showing that plants may precipitate mineral matter equal to several or many times the weight of their own dried tissues, that this mineral matter consists of $CaCO_3$, 93.76; $MgCO_3$, 2.93; SiO_2, 2.40; Fe_2O_3 and Al_2O_3, 0.89 per cent. It is shown that the structure and distribution of the marl are entirely in harmony with the view that a species of Chara is an important agent in its formation; but it is recognized that a species of Zonotrichia has also played an important part, explaining, especially, the more solid and nodular forms of the marl.

A Remarkable Marl Lake. By CHARLES A. DAVIS. *J. Geol.*, **8**, 498–503.—This paper supplements the preceding, describing the truly impressive deposit of marl in Littlefield Lake, Isabella County, Michigan, and showing that it is unquestionably due to the precipitating agency of Chara and Zonotrichia, chiefly through the exhalation of oxygen.

The Composition of Kulaite. By HENRY S. WASHINGTON. *J. Geol.*, **8**, 610–620.—Kulaite is the name given by the author several years ago to a subgroup of the basalts in which hornblende occurs as an essential constituent and surpassing augite in quantity and importance. The original analysis by Röhrig showed, for basalts, abnormally high soda, as well as very high alumina and low magnesia. There seemed to be no mineral pres-

Digitized by Google

ent which would account for the high alkalies, and to determine this and other points two new analyses were undertaken, one of normal kulaite, and the other of a leucite kulaite. The first showed, in comparison with Röhrig's analysis, about 2 per cent. more Fe_2O_3 and as much less K_2O; and the second differed rather widely except for the MgO, CaO, and Al_2O_3. It is surprising to find that all these differences are regarded as probably due to the different analytical methods used. The normal and leucite kulaites are found to agree closely except in the minor constituents TiO_2 and P_2O_5; and the author next considers the place in the classification indicated by this composition. The alkalies and alumina are shown to be too high for a true basalt; and for these reasons and also because of the higher SiO_2 and the lower iron oxides, MgO and CaO, they cannot be referred to the subgroup of hornblende basalts. They are, in fact, properly leucocratic, while the hornblende basalts are melanocratic; and the closest analogues of the Kala rocks are to be found among the nepheline-tephrites and the nepheline-basanites, notwithstanding that many of these are markedly lower in SiO_2, Al_2O_3, and Na_2O. A resemblance to the monchiquites is also noted, the main difference being the higher H_2O content of the latter. Except in the glassy varieties, the essential hornblende has been partially or entirely altered to hypersthene, diopside and magnetite. The component minerals are calculated from the analyses, and nepheline, the presence of which was indicated by the gelatinization and fuchsine tests, is fully confirmed. Certain anomalies of the mineral composition, such as a large proportion of orthoclase in the more basic type, and of leucite in the type running highest in SiO_2 and lowest in K_2O, are explained by reference to difference in pressure and rate of cooling; and the author favors basing the classification of this and other rocks directly upon the chemical composition.

Classification of Igneous Rocks According to Composition. By J. E. Spurr. *Am. Geol.*, **25**, 210–234.—The system of classification proposed here is an outgrowth of a study of a series of rocks collected by the author in Alaska. The system is presented in outline and elaborated only for the feldspar rocks. The principles upon which it is founded are, in the order of importance: (1) Mineralogy, (2) structure, (3) chemical equivalence. The feldspar rocks are divided, according to the nature of their feldspars, into three families, the first or granitic family characterized by alkali feldspars, with 63 to 68 per cent. of silica, the second or dioritic family by oligoclase-andesine feldspars with 56–63 per cent. of silica, and third or diabasic family by labradorite-anorthite feldspars, with 48–56 per cent. of silica. The monzonitic family is intermediate between the granitic and dioritic

Digitized by Google

families, and the belugitic, similarly, between the dioritic and diabasic. The determination of the feldspars being indispensable, the principal methods are discussed. After the feldspars other minerals are considered, first qualitatively and then quantitatively. The ferromagnesian minerals, with the exception of olivine, are reckoned together. They occur throughout the rock series without excluding one another. The predominance of one ferromagnesian constituent over the others is recognized in the division of the groups, or in the species, the latter being designated by writing the characteristic ferromagnesian silicate before the name of the group. The same principle carried further gives the varieties under the species. The mineralogic class, family, group, species, and variety being thus established, the type, which is the actual designation of any given specimen is determined by the structure, which may be (1) granular hypidiomorphic or allotriomorphic, (2) panidiomorphic, (3) porphyritic (phenocrysts in a coarsely holo-crystalline groundmass), (4) porphyritic (phenocrysts in a micro- or cryptocrystalline or glassy groundmass), (5) wholly glassy. The granular structure is regarded as most normal, and the granular types receive the same general names as in the mineralogic classification. To these names are added, for the second type, the word aplite and for the third type the name porphyry; while for the fourth type, which includes the volcanics, the accepted names of the lavas—rhyolite, trachyte, etc., are used; and for wholly glassy rocks the word glass is appended to these names. Age and geological occurrence are rejected as classificatory criteria; and after suggesting that the members of compound or polynomial rock names should be printed in different kinds of type, in order to indicate clearly the value of each, the author discusses at some length the general principles of rock classification, summarizing the views of other petrographers. The division of the feldspars into three main groups, instead of two (orthoclase and plagioclase) is shown to be more symmetrical as regards the silica ratio and other chemical relations. The paper concludes with an illustration in tabular form of the proposed system as applied to the igneous feldspar rocks of Alaska.

Mineralogical and Petrographic Study of the Gabbroid Rocks of Minnesota, and More Particularly of the Plagioclasites. By ALEXANDER N. WINCHELL. *Am. Geol.*, **26**, 151–188, 107–245, 262–306, 348–388.—This is a monographic study of basic igneous rocks covering an area of nearly 3,000 square miles in the northeast corner of Minnesota. The author accepts at the outset the conclusion of the state geologist, N. H. Winchell, that the gabbros are not of deep-seated eruptive origin but have been derived from the fusion of the great greenstone formation of the Lake Superior Archaean. The green stone is primarily of igneous

Digitized by Google

origin, including both massive and clastic forms; and it is regarded as the oldest known terrane of the earth's crust, from which all the later formations of the region have been derived by refusion, the varied processes of metamorphism, and sedimentation. Stratigraphically, the gabbroid rocks are referred to, or constitute, the lower or Cabotian division of the Keweenawan, having originated in a great refusion of the Archaean greenstone at the close of Animikie time. The magma thus resulting consolidating at considerable depth produced gabbros of varying composition; consolidating in intruded laccolites and dikes it produced diabases; and finally as a surface rock it produced lavas and tuffs. The effusive rocks are not included in this study, which is limited to the following nine types: (1) Olivine gabbros, (2) normal diabase, (3) olivine diabase, (4) plagioclasite, (5) troctolite, (6) orthoclase gabbros, (7) cordierite norite, (8) quartz gabbro, (9) silicoferrolite. Each type is described in great detail, and numerous chemical analyses, partly original but chiefly quoted, show the composition of the rocks and their principal component minerals. The normal central type of this gabbro family is the olivine gabbro, from which the other types have been derived by variations due to (1) conditions of solidification, (2) magmatic segregation, (3) contact with other rocks and consequent absorption of foreign elements. These causes of variation are discussed at length, and the conclusion reached that to the first are due the normal diabase and olivine diabase, to the second the troctolite and plagioclasite, and to the third the cordierite norite, through the digestion of aluminous sediment, the quartz gabbro, through the digestion of silicious schists or quartzites, and the orthoclase gabbro through the digestion of a potassic rock; and, finally, the silico-ferrolite is believed to represent a sedimentary rock entirely recrystallized under the exomorphic actions of the gabbro rather than an integral part of the latter. In the section on comparative mineralogy, the mode of occurrence of each one of the forty-two component minerals is considered, nearly one-half of the species being regarded as primary constituents. The concluding section on the comparative chemical composition discusses, first, the methods of analysis, second, the results of analysis, calculated and tabulated to express various molecular and atomic relations, and, third, the application of the different methods of graphic representation to the chemical composition of igneous rocks.

Notes on the Geology and Petrography of Monhegan Island, Maine. By E. C. E. Lord. *Am. Geol.*, **26**, 329–347.—The predominant rock of Monhegan is a coarse-grained, olivine-norite, composed in the order of abundance of plagioclase (50–90 per cent.), olivine, hypersthene, magnetite, diallage, and hornblende.

Digitized by Google

Fluctuations in the relative proportions of the ferromagnesian constituents give rise to the subordinate types: troctolite, norite, olivine gabbro, and gabbro proper. These types represent slight phasal differences in the noritic magma which pass by gradual transition into hornblende-gabbro and gabbro-diorite. The continuity of these rocks is interrupted by coarse-grained segregations or schlieren and a series of acid and basic dikes. The petrographic descriptions are accompanied by analyses of the olivine-norite, hornblende-gabbro, gabbro-diorite, labradorfels, gabbro-pyroxenites, and of the plagioclase (identified as bytownite) and diopside. The dikes include an earlier basic series and later acid series. The former are allied geologically and mineralogically to the basic plutonics which they intersect and to which, apparently, they are restricted, while the latter consist of granitic and aplitic types belonging to a later period of eruption and in no way connected genetically with the Monhegan mass. The acid dikes, composed chiefly of albite>quartz>muscovite>orthoclase>garnet>apatite>magnetite, vary in texture from a fine-grained soda aplite to a coarse granular pegmatitic granite. The analysis of the aplite agrees very closely with that of a soda-granulite from California. The basic dikes are of special interest, as they may be taken to represent products of deep-seated differentiation peculiar to the norite magma. They vary between a hypersthene-gabbro (beerbachite or aplitic gabbro) and a gabbro-diorite (malchite or aplitic diorite). Olivine, the prevailing ferromagnesian constituent of the norite, is wanting in the dikes. An analysis is given for each type, showing that they are essentially identical in composition; and the mean of these analyses agrees very closely with the mean for the hornblende-gabbro and gabbro-diorite, from which we must infer that the dikes represent a textural more than a chemical differentiation of the magma, and that their intrusion was subsequent to the differentiation of these plutonics from the olivine-norite.

Some Contact Phenomena of the Palisade Diabase. By John Duer Irving. *School Mines Quart.*, 20, 213–223.—This paper, which, after noting the gradation in texture, density, and mineral composition between the central and peripheral portions of this great trap sheet, is based chiefly upon the exposures of the upper and lower contacts afforded by the new tunnel of the New York, Susquehanna and Western Railroad, confirms in the main the work of Andreae and Osann, who, in 1892, studied the lower contact only as exposed by the West Shore Railroad. The earlier work recognized four metamorphic phases of the Triassic shale and sandstone, as follows: (1) Normal hornfels; (2) the same rich in tourmaline; (3) altered arkose containing green hornblende; (4) lime-silicate hornfels. To these Irving adds five others, three

Digitized by Google

from the lower contact: (1) Normal hornfels rich in spinel; (2) lime-silicate hornfels containing brown hornblende; (3) normal hornfels containing "augen" and green hornblende; and two from the upper contact: (4,5) Hornfels and arkose hornfels containing richly scattered crystals of andalusite. Each type is described in detail, and the evidence is shown to strongly support the intrusive origin of the diabase, the andalusite and the fact that the hornstone a hundred feet above the upper contact is baked as hard as any below the sheet, being especially conclusive in this regard. Another contact type is believed to be a leucite hornfels, although the analysis shows it to be too high in alumina and soda, and much too low in potash for a pure leucite, the discrepancy being attributed to interstitial matter. Leucite has not been previously described as a contact mineral.

A Brief Review of the Titaniferous Magnetites. By J. F. Kemp. *School Mines Quart.*, **20**, 323–356; **21**, 56–65.—The known deposits of magnetic iron ore may be conveniently classified into two groups on the basis of chemical composition: the titaniferous and the non-titaniferous. This grouping not only corresponds to the chemical composition, but also to the geological relations and to the present utilization and non-utilization. Among the magnetic ores the non-titaniferous are to-day the only ones mined and smelted, and even their productiveness has decreased notably in recent years, because of the great influx of cheap and easily reduced hematites from Lake Superior. The Cornwall banks in Pennsylvania are almost the only large American magnetite mines now in active operation. The geological relations of the non-titaniferous ores are variable, and, in one place and another, they have resulted from very different originals and by strongly contrasted processes, but if titaniferous iron sands are omitted, the massive titaniferous ore-bodies may be said to be closely allied in character and origin wherever they have been studied. With one or two exceptions the titaniferous magnetites are associated, so far as known, with rocks of the gabbro family and furnish a distinct type of ore body, that is singularly uniform the world over. They constitute, in most cases, large irregular masses in the midst of intrusions of igneous rock and seem to have been produced by the segregation of fairly pure titaniferous iron oxide, either before or during the process of cooling and consolidation. In less common instances the entire mass of the dike or stock is so enriched with the iron-bearing mineral as practically to be considered an ore. Although the ores are not at present the objects of active mining, yet the quantity is so large and the iron afforded has such peculiar advantages of its own, doubtless owing to certain chemical elements generally present in the ore, that it seems improbable that they will long go

Digitized by Google

without utilization. The wall-rocks, referred to as belonging to the gabbro family, form an extended series including anorthosite, true gabbro, norite, diabase, and peridotite. To them must be added the Brazilian nepheline-plagioclase rock and the nepheline-syenite at Alno, Sweden. In their mineralogical composition the ores involve both ilmenite and titaniferous magnetite. The latter may be strongly magnetic while high in TiO_2. The strong magnetism of some titaniferous magnetites shows the improbability of removing the titanium by magnetic concentration. In most cases, while the iron is increased in the concentrates by the elimination of the ferro-magnesian silicates, the titanium is also increased. In their chemical composition the ores are characteristic and marked. As a rule, but not invariably, phosphorus and sulphur are notably low or entirely absent. Vanadium, chromium, nickel, and cobalt are almost always present, and they may together amount to several per cent. Magnesia and alumina are often far in excess of what would be required for silicates, and then they are doubtless combined with more or less iron in spinels. Lime is of course involved in the presence of the pyroxenes and related minerals and manganese is often, but not invariably, at hand. This paper consists, after the brief introduction, of summary descriptions, in geographic sequence, of the chief deposits of titaniferous magnetite now known. The descriptions are accompanied by analyses to the number of more than one hundred and seventy, which illustrate for each region the range in composition. This work is thus a complete résumé, and the citations place the reader in command of the literature.

The Origin of Kaolin. By Heinrich Ries. *Trans. Am. Ceramic Soc.*, **2**, Feb., 1900.—Kaolin is defined as any residual clay sufficiently free from iron to burn to a white or nearly white color, and derives kaolin from feldspathic minerals, in part through the agency of carbon dioxide and the ordinary weathering processes (shallow deposits) and in part, as suggested by von Buch and Daubreé, through the agency of ascending acid vapors, including chiefly hydrofluoric acid (deep deposits). Collins' experiment and analyses are cited in support of the latter explanation, but all the economic deposits of the United States are referred to the former. Kaolins containing undecomposed mica cannot be referred to the fluoric type. The practicability of correlating rational analyses of kaolin with the original minerals and the method of derivation is also considered.

Digitized by Google

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 3.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Mines and Mill of the Atacama Mineral Company, Ltd., Taltal, Chili. BY S. H. LORAM. *Trans. Am. Inst. Min. Eng.*, 29, 488–502.—The gold occurs here in very finely divided particles in compact quartz and in fissures in the quartz in the form of spangles upon crystals of baryte and quartz. The ore averages $41.68 per ton; ores assaying under $14.00 per ton do not pay for treatment. There are about 15 per cent. concentrates; some ores contain scorodite (hydrous ferric arsenate). The method of treating is pan-amalgamation, separation of sulphurets, and cyaniding of tailings. The ore is broken in a crusher to ½-inch size and pulverized dry in a Gruson ball mill to pass an 80-mesh screen made of phosphor-bronze. A No. 4 mill is charged with 1320 lbs. of steel balls; it makes 25 revolutions per minute, requires 11 horse power, and treats 6½ tons in 24 hours. The wear of steel from plates and balls is 5.69 lbs. per ton of ore. The amalgamating pans (22 in number) are 5 feet in diameter and 3 feet deep; they are lined to within 6 inches from top and bottom with amalgamated copper plates, and have 4 discharge holes in the sides; of these the lowest is just below the bottom, (a channel in the casting leading to it), the next is 8 inches higher, and the other two are equally spaced. A pan is charged with 88 lbs. mercury, 1100 lbs. ore, and enough sea water to make a thick pulp, the charge being a little over 1 foot deep. The amalgamation lasts about three hours, the muller making 48 revolutions per minute; caustic soda is added if ores containing scorodite are treated. The pan is now filled with water and the amalgam settled for one hour. The sands are discharged through the holes in the sides and enter an agitator (a pan 5 feet in diameter and 5 feet deep, lined with copper plates) from the bottom and

Digitized by Google

overflow at the top. One agitator serves 8 pans. From the agitator the sands are run into a spitzkasten which takes out the concentrates while the overflow passes over a blanket (8 feet long) into a sump whence a centrifugal pump delivers it to the tailings-heaps, where the sands settle, while most of the fine slimes run off to sea. The concentrates, assaying about $14.00 per ton, are weathered and returned to the pan. A pan is cleaned up once a week, when the copper plates are dressed, and the agitator once a month. The tailings average $5.66 per ton representing an extraction of 86.5 per cent. The bullion contains 516 parts gold and 358 parts silver in a thousand. The cyanide plant contains 6 leaching vats (18 feet in diameter, 6 feet, 6 inches deep), and 3 zinc boxes (10 feet, 9 inches long, 2 feet wide, 1 foot, 5 inches deep), having 8 compartments. A vat is charged with 45 tons tailings to which have been added 225 lbs. of lime. The ore is first washed for twelve hours with 10 tons of water containing 0.05 per cent. caustic soda and 0.01 per cent. potassium cyanide; the solution is drained off, passing through the zinc boxes. It is followed by a strong cyanide solution (0.3 per cent.) percolating for four hours, then come 10 tons of weak solution (0.1 per cent.) and lastly 5 tons of wash-water, the last of which, when drained off, contains 0.01 per cent. cyanide. The tailings are discharged by sluicing. A zinc box is charged with 70 lbs. of shavings and the solution passes through it at the rate of 3.3 gallons per minute. The solutions upon entering the boxes contain in 100,000 parts, 0.28 (caustic wash), 0.80 (strong solution), and 0.25 (weak wash) part gold, and upon leaving, they retain 0.1 part gold. The boxes are cleaned up once in ten days. The precipitate, containing about 29 per cent. mercury, is pressed and retorted; the retort gold is melted with borax soda, and sand giving ingots assaying gold 19, silver 21, copper 59, and zinc 1 per cent. The consumption of cyanide is 1 lb. per ton of tailings; the leached tailings assay $6.37 representing an extraction of 80 per cent.

The Purchase of Zinc Ores in the Joplin District. By W. G. Waring. *Eng. Min. J.*, 70, 38–39.—In the European zinc centers the ores are bought and sold upon an assay basis, the valuation being made according to certain formulae which custom has established as being fair to buyer and seller. In the Joplin district the ores have been, until about 1898, purchased exclusively by agents who, judging the blende concentrates by their general appearance, made their offers and took the risks. This one-sided arrangement became unsatisfactory to miners, and at present blende ores are bought on a fairer basis than the mere judgment of the buyer. The purchasing formula now in vogue is $V = WQ - (E + P)$ in which V = value of ore at mine, subject to deductions for lead (50 cents for each unit) and iron ($1.00

Digitized by Google

for each unit above 1 per cent.), W = 80 per cent. of the number of pounds of metallic zinc contained in a net ton of dry ore, Q = the St. Louis spelter quotation per pound at time of purchase, E = cost of treatment including freight, expense ($10.50), P = smelter profit. This is = 100 Q with ore running over 60 per cent. zinc, with under 60 per cent. it is = 100 Q + (10 Q × 60 − A), the assay in per cent. Jig concentrates contain 1–4 per cent. water when shipped, coarse buddle or sludge-headings 10–12 per cent.; when fine, 12–17 per cent. Carbonate ores are still bought and sold in the old way.—An investigation of the losses of zinc in smelting made at one plant showed that 1 part of lime in blendic ore entailed a loss of 2 parts of zinc. The author found that one part of lime present in the ore as carbonate would retain in roasting 0.4–0.7 part sulphur.

The Sadtler Process for Treating Zinc-Bearing Ores. By the Editor. *Eng. Min. J.*, 70, 368–369.—Zinc ores containing over 5 per cent. iron cannot be satisfactorily distilled in the usual fire-clay retort, as the iron corrodes the clay, forming a slag which also scorifies zinc. In this process the retort receives a basic lining not readily attacked by iron or lead. In a trial-test with a furnace containing 30 retorts, oxidized ores were treated containing Fe, 16–30.5; Pb, 1.5–12.89; SiO_2, 2–9; Zn, 16.5–37.5 per cent; Ag, 5–17 ozs., and Au, trace. The loss in retorts was a small fraction of 1 per cent. as against 3 per cent. in Missouri, where blende concentrates with 3 per cent. iron are treated. The precious metals remained in the residue (which also retained 4.2–8.5 per cent. zinc) and served as a basic flux for the lead blast-furnace; the zinc (yield 70–84 per cent.) contained 0.52–1.12 per cent. of lead, and 0.06–0.12 per cent. of iron. It is believed that with a large furnace and regular work the yield in zinc will be 85 per cent. A carload of zinc shipped to a lead-desilverizing plant did as good work as the Missouri spelter. To the regular cost of roasting and distilling of blende there will have to be added from 8 to 12 cents for the lining of each retort, which is, however more than made up by the longer life of the lined retort.

Aluminum-Magnesium Alloys. By R. H. Thurston. *Science*, 11, 783–784.—In view of the appearance in the technical literature of publications on aluminum-magnesium alloys (*e. g.*, Mach's "Magnalium"), the author calls attention to his investigation published in 1893. Magnesium has a breaking strength of 22,250 lbs. per square inch; the elastic limit is 8,870 lbs., the elongation, 2.8 per cent. and the modulus of elasticity, 1,945,000. The following table gives the data on aluminum-magnesium alloys:

Digitized by Google

Per cent. Mg.	Sp. gr.	Breaking strength lbs. per sq. in.	Elastic limit lbs. per sq. in.	Modulus of elasticity.
0	2.67	13,685	4,900	1,690,000
2	2.62	15,440	8,700	2,650,000
5	2.59	17,850	13,090	2,917,000
10	2.55	19,680	14,600	2,650,000
30	2.29	5,000	....	.....

The addition of magnesium to aluminum reduces the elasticity steadily with the increase of magnesium ; the alloy $\frac{1}{3}$ magnesium, $\frac{2}{3}$ aluminum is as brittle as glass. The author believes that the addition of small amounts of magnesium to aluminum will make useful alloys.

Reminiscences of the Early Anthracite Iron Industry. By S. THOMAS. *Trans. Am. Inst. Min. Eng.*, **29**, 901–928.

The Relative Desulphurizing Effect of Lime and Magnesia in the Iron Blast-Furnace. By O. R. FOSTER. *Trans. Am. Inst. Min. Eng.*, **29**, 562–568.—The paper is a record of experiments made in brasqued crucibles heated in a furnace using illuminating gas and forced blast, the highest temperature obtained being 1,550° C., as measured by the Le Chatelier pyrometer. The materials used were Swedish wrought iron (carburized in a graphite crucible, sulphurized with iron sulphides and siliconized with carborundum), chemically pure lime, magnesia and silica. The results indicate in a general way that sometimes lime is the better desulphurizer, sometimes magnesia.

Experiments with Titaniferous Ores. By A. J. ROSSI. *Eng. Min. J.*, **70**, 544.—The author desires to place on record the fact that he has succeeded in producing on a working scale some 20 tons of ferro-titanium and promises details regarding the process and the product later on.

The Effect of Heat-Treatment upon the Physical Properties and the Microstructure of Steel. By R. G. MORSE. *Trans. Am. Inst. Min. Eng.*, **29**, 729–751.—The basis of the experiments was a steel of the composition C, 0.343 ; Si, 0.027 ; Mn, 0.221 ; P, 0.0266 ; S, 0.0037. Bars 1 ft. long were heated to temperatures varying from 500° C. to 1300° C ; they were kept more or less time at these temperatures, then allowed to cool slowly, and the critical point, α_r, determined. They were tested for tensile strength and elastic limit and finally examined microscopically. The paper is accompanied by two diagrams and twenty-six micrographs.

The Relative Corrosion of Wrought Iron, Soft Steel, and Nickel Steel. By H. M. HOWE. International Congress, Methods of Testing Materials of Construction, through *Eng. Min. J.*, **70**, 188.—The paper gives the loss of weight of many

Digitized by Google

plates of wrought iron, soft steel, and nickel steel (3 and 25 per cent. Ni) when exposed to sea water, to river water, and to the weather for two periods of about one year each. The inferences drawn from the results are: (1) "that the difference in the rate of corrosion between wrought iron and soft steel is rarely enough to be of great moment except, perhaps, in marine boilers, and (2) that the ratio of the corrosion of given soft steel to that of given wrought iron may vary greatly with the conditions of exposure." Wrought iron consists of ferrite containing mechanically intermixed some cinder in the form of flakes; soft steel, free from scales, contains cementite. Scale and cementite, resisting oxidation, mechanically protect the ferrite, and having a different potential than ferrite, may hasten or retard the corrosion. The resultant of these two forces must vary with the nature of the attacking medium. The following is a summary of the results of the author's experiments on the relative corrosion of soft steel, wrought-iron, and nickel steel, taking wrought-iron as a standard.

	Sea water.	Fresh water.	Weather.	Average.
Wrought-iron	100	100	100	100
Soft steel	114	94	103	103
3 per cent. nickel steel	83	80	67	77
26 per cent. nickel steel	32	32	30	31

Nickel Steel: A Synopsis of Experiment and Opinion. By D. H. Browne. *Trans. Am. Inst. Min. Eng.*, **29**, 569–648.

Carbide of Silicon in Cupola Practice—A New Softener. By F. J. Tone. *Foundry*, **16**, 117–118.—Carborundum has been found to be very satisfactory in foundry work, especially when dirty or burnt scrap forms part of the cupola charge. Already 1 per cent. carborundum has a marked influence upon the castings. In practice it is customary to charge the carborundum in lump or brick form on top of the coke that the iron, when melting, may be sure to come in contact with it. The heat of the cupola-metal is not sufficiently great to permit adding the carborundum in the ladle as is done in steel castings.

Malleable Cast Iron. By a Correspondent, *Eng. Min. J.*, **70**, 275–276.—The first record of the manufacture of malleable cast iron in this country is of that at Newark, N. J., about 1820. Good malleable castings show: Graphitic C, 3.20–4.00; combined C, 0.10–0.60; Mn about 0.25; S, not over 0.07; P, not over 0.250 per cent. The physical properties are: ultimate strength, 37,000 to 45,000 lbs. per sq. inch, elongation, 3–5 per cent. in 2 inches. For melting, the cupola, and the reverberatory without and with regenerative chambers, are in use. As cupola-metal is difficult to anneal, it is restricted to fine sections. Reverberatory furnaces hold 6–12 tons of metal. It takes about one hour to charge a 10-ton fur-

Digitized by Google

nace, and four to six hours to melt a charge. The castings, after knocking off the gates, are cleaned in tumblers, sorted, packed with iron scale in pots and annealed for four to seven days. The malleableized iron is then again tumbled, the fins are ground off, and the goods shipped either directly or after first dipping into asphaltum thinned with benzene. The author enumerates the many uses malleable castings are put to and gives the names and productions of the leading firms of the country.

Annealing Malleable Cast Iron. By G. C. Davis. *J. Am. Foundrymen's Assoc.*, **8**, 93–104, 121–124; *Foundry*, **16**, 103–106. Discussed by R. Moldenke and H. M. Howe, *Eng. Min. J.*, **69**, 382.—The object of the author was to find out experimentally how far the generally accepted statements were true that white iron when annealed, increased in weight in spite of the large loss of carbon. He found that with a $\frac{1}{8}$ inch bar (Si, 0.60; S, 0.047; total C, 3.23), the increase in bulk was 10.29 per cent. and with a $\frac{5}{4}$ inch bar, 6.17 per cent.; the increase in weight averaged 6.29 per cent. The explanation of this increase in volume given by Moldenke and Howe is that the cementite (Fe_3C) of the white iron is converted in annealing into ferrite and bulky temper-carbon, the latter expanding the metal. The increase in weight is ascribed by the author to the reduction of some of the oxide of iron in the packing by carbon or carbon monoxide, and to its welding to the casting. The experiments showed also that considerable sulphur was absorbed in annealing, the gain in sulphur occurring principally at the surface; in a $\frac{3}{4}$ inch bar the sulphur content in the center remained unchanged, while it increased 0.035 per cent. in the skin ($\frac{1}{80}$ inch thick). The sulphur, the author points out, must have come from the mill-scale used in annealing, samples of wrought-iron scale showing 0.17–0.26 per cent., and of steel scale, 0.061–0.084 per cent. of sulphur.

Shrinkage of Malleable Iron Castings. By H. O. Evans. *J. Am. Foundrymen's Assoc.*, **8**, 125; *Foundry*, **16**, 121.—In discussing Davis' article (see above), Moldenke made the statement that the contraction in chilling, of irons used for making malleable castings, was $\frac{1}{4}$ inch to the foot and the expansion in annealing $\frac{1}{8}$ inch to the foot, leaving $\frac{1}{8}$ inch, the ordinary contraction allowed for gray iron. The author attacks this general statement. He shows that while the shrinkage due to the cooling of the white iron is a pretty constant quantity, the expansion due to annealing shows considerable variety, so that no hard-and-fast rule for the design of a pattern allowing for shrinkage can be made. In fact it has happened that the same pattern sent to different foundries gave castings differing slightly in their dimensions.

Digitized by Google

INDUSTRIAL CHEMISTRY.

F. H. THORP, REVIEWER.

Some Recent Developments in Textile Processes. BY ARON HAMBURGER. *J. Franklin Inst.*, 145, 453.—A full account of Mercer's invention, as set forth in his patent claims, is given, and then follows a description of the processes of mercerizing cotton fibers as now practiced. The manufacture of artificial silk according to the methods of Lehner and Chardonnet is discussed. It is stated that the tetranitrocellulose is the basis of the artificial fiber. The uses of formaldehyde in the textile industries also receives passing notice. By injecting a gelatine solution into a formaldehyde solution, threads are produced having a silky luster. The use of gelatine solution, followed by formaldehyde treatment, is considered in relation to sizing in color printing and for water-proofing. Formaldehyde is being experimented with in making souple silks, to fix or render insoluble the sericine and so prevent loss of weight in the various processes through which the silk passes in finishing.

The Technology of California Bitumens. BY S. F. PECKHAM. *J. Franklin Inst.*, 146, 45–54.—This paper consists of a résumé of investigations and reports by the author and others upon the California bitumens, most of the work having been carried on some years ago. The crude oils were found to contain nitrogenous bodies, soluble in acid, which on further study proved to be pyridine and chinoline. A substance supposed to be a crude paraffin was shown to be a solid olefine or naphthene. The author believes, from his experiments, that these oils contain proportionally large amounts of benzene, and that this explains the difficulty of making good illuminating oils from the crude.

Ammonia and Its Sources. BY BRUNO TERNE. *J. Franklin Inst.*, 146, 127–137.—The recovery of ammonia from by-product coke ovens is first considered, and it is shown that the Otto and Semet-Solvay ovens have a firm establishment in this country. The author inclines to the opinion that the Semet-Solvay oven is quicker in operation than its competitors. Putting the average of ammonium sulphate recovered at 20 pounds per ton of coal coked, the daily loss in the 45,000 bee-hive ovens of this country is over 2,000 tons of sulphate. The Mond gas producer with ammonia recovery is mentioned and the yield of ammonium sulphate put at nearly 100 pounds per ton of fuel. The utilization of sugar-house waste by igniting the molasses with alkali-aluminate, as well as several other processes of similar character, has not yet yielded practical results. Nor is the problem of

Digitized by Google

utilizing atmospheric nitrogen for ammonia yet solved. The results of Lord Rayleigh's, and Siemens and Halske's experiments on the oxidation of nitrogen by the influence of the electric spark, show that an alkali must be present to unite with the oxides at the moment of formation. The experiments of Russell and Frank on producing nitrides by heating calcium carbide and magnesium, aluminum, or zinc powder, and also the production of nitrides in the electric furnace by the methods of Mehner and Willson, are briefly considered; these electric methods are favorably looked upon. The production of nitrogen in the soil by the action of bacteria cultures is considered to be yet in the experimental stage. The utilization of garbage as a source of fertilizer and of grease is prominently brought out; it is shown that the garbage of New York and Brooklyn alone will add to the annual output 2,400,000 pounds of ammonia in the form of fertilizer.

History of the Portland Cement Industry in the United States. By ROBERT W. LESLEY. *J. Franklin Inst.*, 146, 324–348.—The principles of hydraulic cement making were discovered by Smeaton towards the end of the 18th century. The first natural cements made by calcining and grinding suitable argillaceous limestones was made by Parker in 1796; in 1824 Aspdin produced the first Portland cement from a mixture of chalk and clay, calcined at a high temperature, and ground to fine powder. The natural cement industry was early started in this country and has continued to thrive to the present time. Portland cement was first made here in 1870, and the industry has now reached large proportions. The improvement of the rotary kiln gave a great impetus to the industry, while the introduction of other labor-saving devices and improved grinding appliances, notably the Griffin mill and tube-mill, have enabled American cements to displace, to a considerable extent, those of foreign manufacture. The author discusses the materials and their handling for the making of the cement, the chemical analysis of certain type cements, as shown by tables for eleven domestic and ten foreign brands, the testing of cement, and the growth of the industry as shown by statistics.

High Explosives and Smokeless Powders and Their Applications in Warfare. By HUDSON MAXIM. *J. Franklin Inst.*, 146, 375–386, 457–464.—This paper is a discussion of the properties of various high explosives and a plea for their use in high-power guns and for large shells. Attention is directed to the well-known fact that increasing the density of an explosive diminishes its sensitiveness to detonating shocks; that guncotton in the fibrous state is readily detonated, but that, if dissolved and rendered hard and horny by evaporation of the solvent, it resists de-

Digitized by Google

tonative influences. Fine granulation of such a material is necessary to insure complete burning, and this presents so much surface that dangerous pressures are reached in the gun if it be over four-inch caliber. A description of the Maxim-Schüpphaus smokeless cannon powder is given: A mixture of high grade guncotton containing a little soluble pyroxylin is rendered plastic with very little solvent and is molded into grains under heat and pressure; these grains, in drying, shrink but little and retain the shape of the die. Nitroglycerine may be added to the mixture, and is recommended in proportions of 10 to 25 per cent. The form of the grain is one of its chief features, it being multi-perforated, which is claimed to increase its ballistic power. The grain proposed for large charges is a cylinder six diameters long and pierced longitudinally by nineteen angular perforations. The exterior of the grain is coated with a non-combustible coating. Assuming, as an example, the 12-inch sea coast rifle, throwing a shell weighing 1,000 pounds at a velocity of 2,250 feet per second, on a pressure of 35,000 lbs. per square inch, it is claimed that a gun of 24-inch caliber and of same length as the 12-inch gun would show an average pressure just half that of the 12-inch gun; but the area of the base of the projectile being four times as great in this case, a shell of twice the weight of the 12-inch shell could be thrown at the same velocity. The additional weight could be made up of high explosive instead of the black powder now used. The last part of the paper deals with the economic and humane aspects of the "business of war."

A Process of Fire-Proofing Wood To Be Used for the Wood-Work of War Vessels. By C. J. HEXAMER. *J. Franklin Inst.*, 147, 65–70.—The process consists in saturating the pores of the wood with a solution of water-glass and then decomposing it with a solution of ammonium chloride, by which gelatinous silica is precipitated in the pores of the wood. Well-seasoned, kiln-dried timber is put into a chamber, capable of withstanding strong pressure, and which can be heated externally by steam. The chamber is sealed, the temperature brought to 60° C., and kept there. The air is exhausted as thoroughly as possible with an air-pump; the solution, previously heated to 60° C., is then sprayed into the chamber until the wood becomes saturated, then the vacuum is broken, and a pressure of ten atmospheres is applied and kept up for three hours. This forces the liquid through the mass. It is insisted that steaming the wood previous to saturating it is injurious and prevents the thorough penetration of the liquids.

Methods for the Examination of Explosives. By W. J. WILLIAMS. *J. Franklin Inst.*, 147, 197–215.—The author first considers the "service tests," in which the stability of the powder under the influence of heat is determined. The powder is ex-

Digitized by Google

posed to a temperature of 150° F. until indications of decomposition of the nitro-compounds are observed. Iodo-starch paper is used, which shows a brown or yellow color as soon as acids or nitrogen oxides are set free. The specific gravity is next determined by the use of mercury in a vacuum. The gravimetric density, or "ratio which the weight of the substance bears to the volume it occupies," is then determined in the DuPont gravimetric balance. The loss of weight, when heated at 130° F. for twenty-four hours, and the increase of weight when exposed to an atmosphere saturated with moisture for twenty-four hours, are also determined. The powder is then exposed in an air-tight box to great cold (—35° F. to —40° F.) for six hours, and any gain or loss in weight is noted. It is then exposed to the air for twenty-four hours and any gain or loss of weight determined. After each of these tests the powder is tested for the velocity and pressure when fired in the gun. The uniformity of granulation is determined by a set of sieves with circular perforations ranging from 0.10 to 0.03 of an inch in diameter. Lastly, the "fouling" capacity of the powder is found by burning it on a watch-glass and weighing the residue. The chemical tests are quite elaborate, including the determination of nitrogen by dissolving the powder in concentrated sulphuric acid, shaking with mercury, and measuring the volume of nitric oxide liberated. For nitro-substitution compounds, where this method cannot be used, a modified Kjeldahl or Gunning method is used. Moisture and volatile matter are determined by twenty-four hours' exposure in an air-bath at 50° C., followed by one day or longer in a vacuum desiccator over concentrated sulphuric acid or calcium chloride. The analysis of explosives is then explained, using guncotton as the type; then the analysis of a powder is explained. In an appendix the theory of the decompositions of guncotton, of nitroglycerine, and black powder is illustrated by reactions.

Graphite: Its Formation and Manufacture. By E. G. Acheson. *J. Franklin Inst.*, 147, 475–486.—The history, distribution, and uses of natural graphite are first discussed, and then the methods proposed for the artificial production are outlined. The greater part of the paper is devoted to the author's process of forming graphite in the electric furnace, by the decomposition of a carbide. As raw material he employs coke, and he has found as a result of his experiments that the pure coke from petroleum stills will form little or no graphite, while the best yield is obtained from impure coke made from bituminous coal. Only a part of the coke is converted into graphite. The first operation is the formation of the carbide and the second is its decomposition. The theory of formation is explained, and the author states his conclusions from his own experiments, as fol-

Digitized by Google

lows: (1) Graphite is the form carbon assumes, when freed from chemical associations, under conditions of low pressure and protection from chemical influence. (2) Diamond is the form carbon assumes, when freed from chemical associations, under conditions of high pressure and protection from chemical influence. (3) Amorphous carbon is the form assumed when freed from chemical associations, under conditions of low or high pressure and exposure to chemical influences. It is also supposed that catalysis occurs, under certain conditions, during the transformation of amorphous into graphitic carbon. Then follows an account of the commercial operations under way for the development of the process for manufacturing graphite. It is also shown that a specific name for the new product is desirable, exception being taken to the word "artificial," since it conveys the impression that a cheap imitation is being palmed off as the genuine article. "Manufactured graphite" is also excluded, since it is now applied to the articles made of graphite.

The Laboratory Production of Asphalts from Animal and Vegetable Materials. By Wm. C. Day. *J. Franklin Inst.*, 148, 205–226.—The author distilled a mixture of fresh fish (herring) and fat pine wood in an iron retort, and passed the products of distillation directly through a red hot iron tube and thence to a Liebig condenser. He obtained a yellowish-red aqueous distillate and a dark, nearly black, oil, most of which was lighter than water, although a part of it coming over towards the end of the process was heavier. The oil was dried and analyzed, and then distilled by itself in a glass retort. Five distillates were separated at 180°, 245°, 315°, and 340° C. and at 425° (estimated). There remained in the flask a black liquid which solidified, on cooling, to a mass resembling the natural gilsonite in composition and properties. Determinations of carbon, hydrogen, nitrogen, and sulphur, were made, and the solubility in carbon bisulphite, turpentine, ether, gasoline, and absolute alcohol was determined. All of the solutions showed a greenish fluorescence. The action of nitric acid on gilsonite and on the artificial product was similar. Basic compounds similar to pyridine and quinoline were obtained both from gilsonite and from the artificial product. Distillations of fish alone and of wood alone were made in the same apparatus and oil and water obtained. On redistillation this oil left a residue similar to maltha. On analysis it resembled natural elaterite. Basic substances were obtained from this oil similar to those from the gilsonite. The solubility was also studied. From the distillation of the wood a larger proportion of a strongly acid oil resulted. On redistilling, the same fractions were taken as previously, and the residue in the retort was a black liquid which solidified, on cooling, to a black mass,

Digitized by Google

showing a purple color in thin edges. Tables of analyses and solubilities are given. No traces of basic substances could be found in these oils from wood alone. Comparative tables of analyses, specific gravities, and solubilites of gilsonite and elaterite, and of these artificial oils, are given. A lengthy discussion of the origin of natural asphalts and bitumens, and of petroleum, follows. The author inclines to the idea that no one theory can explain all of the known occurrences of different bitumens.

What is Parianite? A Correction. By H. Endemann. *J. Franklin Inst.*, 149, 314.—The author explains an error, due to a misapprehension in Keller's contribution to the discussion of the paper by S. F. Peckham (*this Rev.*, 6, 124). From the reading of the report it would appear that the author had made no attempt to isolate compounds of definite composition from asphalt generally, whereas he had merely neglected the petrolenes, these being the subordinate portion of asphalt. He has given his attention chiefly to the solids of asphalts.

Recent Progress in the Aluminum Industry. By Joseph W. Richards. *J. Franklin Inst.*, 149, 451–459.—This is an abstract of a lecture before the Institute. But little is said concerning the metallurgy of aluminum, the greater part of the paper being devoted to its commercial uses. It is shown that alloys of aluminum are relatively cheaper than brass, bronze, or copper, considering the difference in specific gravity. The only metals that are cheaper than aluminum are iron, zinc, and lead. It is rapidly replacing brass and copper for artistic effects, while for culinary utensils, toilet articles, and novelties, its use is steadily increasing. For fruit-jar caps it is replacing zinc, although more expensive. For lithographic printing, aluminum plates are superseding the time-honored stone; they give fully as fine work and may be used on cylinder presses, thus allowing much faster running. For electric conductors aluminum is replacing copper, and promises to seriously affect the copper industry in this respect. Powdered and leaf aluminum has entirely replaced silver for decorative uses, and is also proving useful in the reduction of refractory metallic oxides; in this way, manganese, chromium, tungsten, vanadium, uranium, boron, and molybdenum have been reduced and utilized in alloys for steel making.

Aluminum: Considered Practically in Relation to Its General Application in the Arts and Mechanics. By Joseph A. Steinmetz. *J. Franklin Inst.*, 150, 272–284.—This is a somewhat more extended, but similar, article to that by Richards (see above). The use of aluminum in the metallurgy of steel is noted, and also its use for making patterns. For models and salesmen's samples, the lightness of the metal makes it well

Digitized by Google

adapted. The difficulty of soldering it is mentioned and some of the causes of failure pointed out. The statistics of the industry are given. An instance of the failure of aluminum for bath-tub making, owing to corrosion by soap and alkali, is shown ; and for plumbing fixtures the metal is generally unsuitable. The metal finds use in making steam-jacketed pans for sirup, honey, fruit-juices, etc. The uses of the metal for electrical work and for cooking utensils, and its employment in ship building, are fully explained. Aluminum powder and its uses are considered; among these, it is mentioned that it can replace magnesium for flash-lights in photography.

The Occurrence of Fuller's Earth in the United States. By DAVID T. DAY. *J. Franklin Inst.*, 150, 214–223.—The characteristics of the material are first considered. The different specimens of earth vary in composition, and no definite mineral substance of distinctive character can be found in all varieties. Any form of clay, which is capable of absorbing considerable quantities of liquids, which crumble in water and diffuse readily, and which will remove grease from wool or coloring-matters from oils, is a fuller's earth. The developments in the United States are then mentioned, and it is shown to be widely distributed. The conditions of its occurrence and its preparation for market are explained. The methods of using it for bleaching mineral and vegetable oils are stated, and it is suggested that, since the oils of different density in such a mixture as crude petroleum percolate through it at different rates, the first runnings being of lighter color and of lower specific gravity than those which follow, there is a possibility of separating such oils without fractional distillation, and hence without the production of decomposition-products. A table of analyses of a number of samples of the earth is also given.

The Influence of Science on Modern Beer Brewing. By FRANCIS WYATT. *J. Franklin Inst.*, 150, 190–214 ; 299–320.—The author begins with a history of the development of the brewing industry. With the coming of the chemist into the brewing industry it was found that malt contained more diastase than is needed to hydrolyze its own starch, and that some of the troubles of the brewer were due to excessive quantities of nitrogenous bodies in soluble form in the beer. Hence came the use of raw grain to utilize the diastase and, by creating a greater mass of material, to diminish the proportion of proteids in the beer. The nature of the water used was also early recognized as important and its complete analysis is now customary. It is generally asserted that the sum of the quantities of earthy sulphates and carbonates should never exceed 100 parts per 100,000. Iron in quan-

Digitized by Google

tities greater than 0.5 part per 100,000, is objectionable and should be removed. But a moderate amount of permanent hardness is desirable in the water, and by adding hardening salts soft waters may be improved. The bacteriological examination of the water is briefly explained. The properties and constituents of malt are considered and figures given showing the decrease of diastatic power, as influenced by the kilning process. The influence of temperature on the mashing process is explained, and it is shown that chemists have taught the brewers to use care in attaining a proper temperature in the mash. The use of starchy or saccharine materials, called malt-substitutes or malt-adjuncts, is now general and has resulted in an improved quality of the beer; cereals are specially prepared for this use, while grape-sugar and glucose have long been favorite materials. Raw cereals must be gelatinized at high temperatures to liberate the starch from the cells, before being subjected to the action of the malt at the lower temperature of the mash-tub. Hops are now subjected to analysis ; the percentage of water and tannin are determined, as well as the condition and quantity of the lupulin and the amount of extract yielded to petroleum ether, chloroform, and water. Yeast and its properties and the effects of wild yeast and bacteria are then described. The author states the theory of alcoholic fermentation as formulated by Pasteur, and also the new theory of Buchner, that the decomposition of sugar into alcohol and carbonic acid gas is independent of vital action, being produced by a functional product of the yeast cell, an enzyme, which is excreted during its growth, and called zymose. A method for its preparation is given, and it is described as a clear but opalescent yellow fluid with the odor of yeast and a minimum specific gravity, 1.0416. A description of a modern brewing plant is given, and the changes which take place during the mashing are considered. An outline of the brewing process follows, and analyses of the wort with and without raw grain, and of the finished beers from these worts are shown. It is demonstrated that the character of the components of both beers is identical ; that the differences in their composition are only those intentionally created, and that the modern scientific brewer may change the nature of his beers at will ; that he can foretell the result to be obtained by the use of any process he may adopt. The chief points to be looked for in the worts are then clearly stated. The effect of reduced temperatures in precipitating soluble nitrogenous bodies of the albumose and peptone types is explained. Statistics of the industry in the United States since 1868 and a recapitulation of data in the paper, close the article.

Water-Softening Plant at the Lorain Steel Company's Blast-Furnaces. By N. O. Goldsmith. *Power*, **20**, No. 10.—This is

Digitized by Google

mainly a description of the mechanical plant for an intermittent settling process of water purification. It includes an analysis of the water of Black River, Ohio, and also a series of analyses of the water before and after treatment for a period of three months, showing the reduction in the amount of lime and magnesia by treatment. A table of the cost of precipitating 1,000 grains of different impurities with different reagents is also included.

Note: On Carborundum. By CHAS. F. MABERY. *J. Am. Chem. Soc.*, **22**, 706.—Attention is here called to the fact that the U. S. Circuit Court of Appeals has decided in favor of the patent of A. H. and E. H. Cowles, Dec. 24, 1884, and against that of E. H. Acheson, thus determining the question of priority for the incandescent method of reducing ores and other substances.

Portland Cement—Sketch of Materials and Process. By S. B. NEWBERRY. *Eng. Record*, **42**, 436–438.—The subject is discussed under the heads: Introduction, Materials, Proportions of Ingredients, Mixing, Burning, Grinding. The three general classes of hydraulic cements, Portland cement, Natural cement, and Puzzalona or slag cement are defined. The materials for Portland cement are considered in detail and several analyses of carbonate of lime and clays used for cement are included. Under the proportions of ingredients the formula of Le Chatelier is given together with the author's formula based on his own experiments; thus from the formula

$$X(3CaO.SiO_2) + Y(2CaO.Al_2O_3),$$

he deduces the following rule for calculating the amount of lime required for any particular clay of which an analysis has been made: Multiply the percentage of silica by 2.8 and the percentage of alumina by 1.1; add the products; the sum equals the number of parts of lime required for 100 parts of clay. An example of the use of the formula is given. The author's experiments show that magnesia forms with clay no products having hydraulic properties, hence in calculating cement mixtures only the silica, lime, and alumina are considered. The methods of mixing are briefly explained, the semi-wet process being considered preferable. Under burning, the four types of kilns used for Portland cement are discussed. In this country the rotary kiln is preferred owing to its low labor account, but it is very wasteful of fuel. Le Chatelier's theory of the changes caused by the burning is stated, and the peculiar effect of sudden cooling of the hot clinker is noted. For grinding the clinker, the Griffin mill and tube-mill have generally replaced buhr-stones in this country. The fineness is such that 92–93 per cent. will pass a No. 100 sieve. It is claimed that the average tests of American cements are higher than those of English or German make.

Digitized by Google

The Michigan Alkali Co.'s Plant for Manufacturing Portland Cement from Caustic Soda Waste. By B. B. LATHBURY. *Eng. News*, 43, 373. **The Raw Materials for the Manufacture of Portland Cement.** *Editorial, Eng. News*, 43, 376.—These two articles are in a measure complementary; the first is chiefly devoted to the engineering features of cement manufacture, but it includes analyses of the "waste" employed and also of the clay and of the limestone from which the lime is prepared for use in the causticizing plant. The second article is a compilation of facts relating to the materials, including tables of analyses of them and of representative foreign and domestic cements from various sources.

How to Calculate the Proper Cement Raw Mixture from the Given Raw Materials. By W. MICHAELIS, JR. *Cement and Eng. News*, 9, 21.—This is chiefly a review of the work of W. Michaelis, Sr., in determining the "Hydraulic Modulus." A formula is given, and the use of this modulus in calculating the ratio of clay to chalk from the analyses of the raw materials is illustrated by an example.

Chemical Industry of Germany. By R. GUENTHER. *U. S. Consular Rep.*, 64, 186.—The chief features of this report are a table of German imports and exports of chemicals for the years 1898 and 1899, and a table of exports to the United States in 1898. The United States then imported $8,383,000 worth of chemicals, exclusive of a large number of chemicals whose value is not stated.

Cellulith. By R. GUENTHER. *U. S. Consular Rep.*, 64, 461.—This is a short description of the method of making cellulith from paper pulp. The finished product, which has a specific gravity of 4.5, has the consistency of horn, and when incorporated with sawdust and lampblack, resembles ebonite.

Silver-Mounted Ware a Menace to Health. By WALTER SCHUMANN. *U. S. Consular Rep.*, 64, 374.—A Franfort newspaper is quoted to the effect that the silver on the mountings on certain glass and porcelain wares is applied by a galvanoplastic process, using baths strongly charged with potassium cyanide. It is claimed that the poison enters the fine cracks and crevices of the glazed ware, remains there, and is a source of danger in the use or handling of the articles. A case of poisoning is stated to have been traced to such a source. These goods are stated to be chiefly exported to the United States.

New Substitute for Gutta Percha. *U. S. Consular Rep.*, 64, 369.—The composition of the new substitute is secret. At ordinary temperatures the substance is hard and firm, but not brittle; it may be hammered without breaking. It softens on warming, but is not affected by water.

Digitized by Google

Chemical Foods in Germany. By O. J. D. Hughes. *U. S. Consular Rep.*, 64, 23.—This contains a short list of the more important artificial food-products containing albuminose bodies.

New German Glass. *U. S. Consular Rep.*, 64, 131.—"Theophilus glass" is the name of a new material which, like the "Tiffany glass of this country," is intended for artistic uses.

Composition of the Ashes of Some Raw Tanning Materials. By Wm. K. Alsop and J. H. Yocum. *J. Am. Chem. Soc.*, 20, 338–340.—Tables are given showing the composition of the tanning material and giving complete analyses of its ash. The materials examined were chestnut-oak bark, hemlock bark, quebracho wood, and oak-bark extract.

Killing Weeds with Chemicals. By L. R. Jones and W. A. Orton. *Vt. Agr. Expt. Sta. Rep.*, 1899, 182–188.—The authors have tried the effects of salt, copper sulphate, potassium sulphide, sodium arseniate, arsenious oxide mixed with sal soda, kerosene, crude carbolic acid, and some other substances, in killing weeds in gravel walks, tennis courts, and other dry beaten soils. About 8 gallons of solution were applied to each square rod of area, the weeds chiefly present being knotweed, grasses, plantain, dandelion, and others. Knotweed was hardest to destroy. Salt requires heavy application, in the dry form, and is liable to be washed onto neighboring lawns and borders; crude carbolic acid is quick and powerful, but not enduring. Arsenical compounds, especially sodium arseniate, are effective, but their use depends upon convenience and expense.

Analyses of Fertilizers. *Mass.* (*Hatch*) *Agr. Expt. Sta. Rep.*, *1899*, 108–122; *Bull.* 65; *N. H. Agr. Expt. Sta. Bull.*, 69; *N. Y. Agr. Expt. Sta. Bull.*, 173, 531–552; *Vt. Agr. Expt. Sta. Rep.*, 1899, 148–150; *W. Va. Agr. Expt. Sta. Bull.*, 63, 115–152; *Wis. Agr. Expt. Sta. Bull.*, 81; *N. Da. Agr. Expt. Sta. Rep.*, 1899, 13–14; *Wash. Agr. Expt. Sta. Bull.*, 40; *N. J. Agr. Expt. Sta. Rep.*, 1899, 17–85; *Me. Agr. Expt. Sta. Bull.*, 60, 23–30; 66, 117–132; *Mass. State Board Agr. Rep.*, 1899, 131–169; *Md. Agr. Coll. Quart.*, 1900, 67; *R. I. Agr. Expt. Sta. Bull.*, 60, 67, 70, 73; *S. C. Agr. Expt. Sta. Bull.*, 53, 54; *Ky. Agr. Expt. Sta. Bull.*, 85, 88.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

C. H Warren, Reviewer.

Action of Ammonium Chloride upon Analcite and Leucite. By F. W. Clarke and G. Steiger. *Am. J. Sci.*, 159, 117–124.—The article records the results of an investigation on the action

Digitized by Google

of ammonium chloride upon the minerals analcite and leucite when the latter are heated separately with this reagent in sealed tubes at 350° C.; also the meaning which the results obtained have in regard to the chemical constitution of the two minerals. Both minerals suffer a substitution of their alkali by ammonium, yielding the same compound whose composition is that of an ammonium leucite, $NH_4AlSi_2O_6$. This fact is believed to indicate an original similarity in the two minerals, which is also borne out by crystallographic and other resemblances. A further study of the chemical properties of the ammonium derivative leads the authors to think that analcite and leucite are not true metasilicates, but either salts of a polymeric metasilicic acid or a mixture of ortho- and tri-silicates.

Chemical Study of the Glaucophane Schists. By H. S. WASHINGTON. *Am. J. Sci.*, 161, 31–59.—A consideration of the chemical and mineralogical composition of the above class of metamorphic rock as shown by a series of admirable chemical analyses of specimens from some seven localities, leads to conclusions concerning their classification and origin, which are briefly and concisely given by the author in his summary as follows: "The Glaucophane schists belong to two main groups, sharply separated from each other. The larger one is basic, composed chiefly of glaucophane and epidote, often with abundant garnet, zoisite, diallage, and sometimes smaller amounts of mica, feldspar, and quartz, and rutile and titanite as frequent accessories. Chemically, these closely resemble the composition of the rocks of the gabbro family, and are apparently divisible into two subgroups, one high in lime the other low in it. These are in most cases amost undoubtedly derived from such igneous rocks or their tuffs, but also possibly in rarer cases from sediments or slates of similar composition. These basic glaucophane schists scarcely differ in composition from the amphibolites and eclogites, and the difference in their formation is probably to be ascribed to differences in the conditions of metamorphism. A smaller, but widely spread, group is acid in composition, and these are composed largely of quartz and glaucophane, with mica and sometimes albite. These are derived from cherts, quartzites, or quartzose shales and sandstones. The existence is indicated of a third, still smaller, group of intermediate mineralogical composition, and chemically like the diorites. The glaucophane schists are apparently the result of both regional and contact metamorphism, and in many regions they occur together. This last seems to be the rule in glaucophane schist areas of any size, and where only the one kind is found the area is apt to be small."

The Mode of Occurrence of Topaz near Ouro Preto, Brazil. By ORVILLE A. DERBY. *Am. J. Sci., No. 165*, 25–34. The arti-

Digitized by Google

cle gives the results of a study of the associated earths and rocks where the topaz is found. The mineral itself is found in a dark-colored earth, which is thought, from its mineralogical character and its geological relations, to represent the remains of an igneous dike in which the topaz was an original mineral. What the exact nature of the igneous dike was cannot be told on account of its extreme state of alteration.

Carnotite and Associated Vanadiferous Minerals in Western Colorado. By W. F. Hillebrand and F. Leslie Ransome. *Am. J. Sci.*, **160**, 120–144.—The paper embodies the results of investigations concerning the occurrence and nature of the uranium and vanadium ores of Western Colorado. A somewhat detailed description of the various ore deposits is given by Dr. Ransome from a study of the region made by him and A. C. Spencer. He concludes that the ores are recent impregnations in the sandstones. The chemical researches made and recorded by Dr. Hillebrand furnish not only valuable data concerning the composition of the ores and their constituent minerals, but afford the chemist excellent descriptions of the analytical methods involved in the analysis of the uranium and vanadium ores. The summary made by the authors is as follows: "The body called carnotite is probably a mixture of minerals of which analysis fails to reveal the exact nature. Instead of being the pure uranyl-potassium vanadate, it is to a large extent made up of calcium and barium compounds. Intimately mixed with it, and entirely obscured by it, is an amorphous substance—a silicate or mixture of silicates—containing vanadium in the trivalent state, probably replacing aluminium. The deposits of carnotite, though distributed over a wide area of country, are, for the most part, if not altogether, very superficial in character and of recent origin. The green coloring and cementing material of certain sandstones near Placerville, Colorado, is a crypto-crystalline alumino-vanadio-potassium silicate resembling roscoclite, but with the percentage proportions of Al_2O_3 and V_2O_3 reversed. It constitutes over 25 per cent. of the sandstone at times, and contains nearly 13 per cent. of V_2O_3, the latter amounting in the maximum case observed to 3.5 per cent. of the sandstone. As yet these highly vanadiferous sandstones have been found only at Placerville, where it is intended to work them for vanadium. Carnotite is associated with them in only trifling amount. Other sandstones noticed owe their bright green color to chromium. In yet another case, where the color was dull green, this was not due to either chromium or vanadium.

Notes on the Tellurides from Colorado. By Charles Palache. *Am. J. Sci.*, **160**, 419–427.—The article gives the results of a careful and admirable crystallographic study of the

Digitized by Google

mineral sylvanite, together with a chemical investigation of the same. The analyses show the composition to be represented by the formula $AuAgTe_4$, thus confirming the conclusions previously reached by Pearce from analyses made by him on massive material from Cripple Creek. The goldschmidtite of Hobbs is shown by the author to be identical in crystallization with sylvanite. Owing to this identity it is thought that the analyses made by Hobbs may have been rendered inaccurate by the extremely small quantity with which he worked, and in a note incorporated in the article, Prof. Hobbs withdraws the name goldschmidtite as representing a distinct species. The article is concluded by a note on the crystal habit of hessite from Boulder, Colorado.

Mohawkite, Stibio-Domeykite, Domeykite, Algodonite, and Some Artificial Copper Arsenides. By GEORGE A. KOENIG. *Am. J. Sci.*, 160, 439–448.—The copper arsenides occurring in the Keweenaw copper formation of Michigan are found only in veins intersecting the bedded deposits of native copper, and have so far been observed only near the foot of the formation toward the southeast. The new mineral mohawkite occurs in a vein at the Mohawk Mine associated with other copper arsenides in a gangue of quartz and calcite. The mineral is massive, structure granular to compact, color a gray, tinged with yellow, taking readily a brassy to purplish tarnish. It is brittle, hardness about 3.5, with a specific gravity of 8.07. A chemical analysis gives its composition as follows: Cu, 61.67; Ni, 7.03; Co, 2.20; Fe, trace; As, 28.85; this gives the mineral the formula $(Cu,Ni,Co)_3As$. The author shows also that nickel and cobalt are present in small quantities in the mineral domeykite Cu_3As, and that the specific gravity of the latter should be 7.94 instead of 6.7 to 7.5, as given by the mineralogies. By volatilizing arsenic over red hot copper in a combustion tube, sealed at one end, two arsenides were obtained, one having the composition Cu_2As and resembling chalcocite, the other consisting of groups of minute crystals and identical with domeykite in composition. By the name stibio-domeykite the author designates a mineral from the Mohawk Mine, closely resembling domeykite but containing a small percentage of antimony, and by the name mohawk-whitneyite a very intimate mixture of the two minerals mohawkite and whitneyite. The results of several analyses of these last mixtures accompany the article. The correctness of the formula $(Cu,Ni,Co)_4As$, which was assigned to mohawkite by Ledoux (*Eng. Min. J.*, April, 1900) is strongly denied by the author. He concludes his with a new analysis of algodonite, confirming the formula Cu_6As. Its specific gravity was found to be 8.383, instead of 7.62, as previously given.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 4.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H Thorp.

ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

On the Behavior of Acylthioncarbamic Esters with Alkyl Iodides and Amines: Benzoylimidothiocarbamic Esters, Acyclic Benzoylpseudoureas and Benzoylureas. BY HENRY L. WHEELER AND TREAT B. JOHNSON. *Am. Chem. J.*, **24**, 189–221.—The acylthioncarbamic esters used in the investigation were prepared by the union of acyl rhodanides with alcohols. It was found that these compounds have little tendency to undergo molecular rearrangement with alkyl iodides, and that this rearrangement took place only in the case of the acetyl and benzoyl methyl esters when warmed, within narrow limits, with methyl iodide. The thion compound was converted into a thiol derivative, $CH_3CO.NH.CS.OCH_3 \rightarrow CH_3CO.NH.CO.SCH_3$. The thiol derivative was also prepared by warming methyl thiolcarbamate with acetic anhydride. The results show that the compounds formed by the union of acyl rhodanides and alcohols have the thion and not the thiol structure which is assigned to them in Beilstein's "Handbuch." It was found that methyl benzoylthioncarbamate reacts more readily with chloracetic acid than with alkyl iodides, giving benzoylcarbaminethioglycollic acid, $C_6H_5CO.NH.CO.SCH_2.COOH$. In previous papers by the authors it has been shown that such thioncarbamic esters as have a more or less positive nature, such as the phenylthioncarbazinic ester, $C_6H_5NH.NH.CS.OC_2H_5$, readily react with alkyl halides and with compounds of a negative character; while, on the other hand, they proved to be quite inactive with organic bases. It is now shown in the case of the negative benzoyl thioncarbamic esters, that the behavior is the reverse. These compounds react with ammonia and organic bases at ordinary temperatures, form-

Digitized by Google

ing direct, more or less stable, addition-products, which break down in a variety of ways, dependent upon the character of the amine radicals. As it was suspected that acyl pseudourea ethers were formed in some of the decompositions, compounds of this class were prepared from benzoylimidothiocarbonic esters, and studied. These latter compounds, $C_6H_5CO.N:C.SR.OR$, are readily formed by the action of alkyl iodides on the sodium salts of the benzoylthioncarbamic esters, and are oils, which boil under diminished pressure without decomposition. With water, they give benzamide, carbon dioxide, an alcohol, and a mercaptan. They are converted by hydrogen sulphide at 100° into benzoylthioncarbamic esters, and by dry hydrogen chloride into benzoylthiolcarbamic esters. When benzoylimidothiocarbonic esters are treated with organic bases they readily react, giving off mercaptan and forming acylpseudourea ethers:

$$C_6H_5CO.N:C\begin{matrix}SR\\OCH_3\end{matrix} + HNR'R'' =$$

$$C_6H_5CO.N:C\begin{matrix}NR'R''\\OCH_3\end{matrix} + HSR.$$

The compounds of this type are oils, which cannot be distilled without decomposition. They resemble closely in properties the acylimido esters and acylamidines, to both of which series the compounds belong. The most striking reaction of these pseudourea ethers is the reaction with hydrochloric acid. With this reagent the ethers react in the cold; alkyl chlorides are given off, and they are quantitatively converted into well-crystallized acylureas. The results show that the more negative the character of the radical in the imido ester grouping, $RN:CR'.OR''$, the more sensitive are the compounds in regard to decomposition with hydrochloric acid. The acylthioncarbamic esters react with phenylhydrazine, giving off hydrogen sulphide in the cold. Ring compounds are formed and obtained. This was proved by converting the compound represented by formula I from methylbenzoylthioncarbamate into the so-called 1,5-diphenyl-3-oxytriazole which is represented by formula II.

I. $C_6H_5.C=N-C.OCH_3$ (with $C_6H_5.N$ and N)

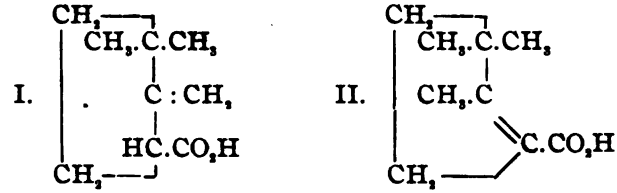
II. $C_6H_5.C=N-CO$ (with $C_6H_5.N$ and NH)

The preparation and properties of a large number of compounds are described.

Camphoric Acid—Structure and Configuration of Cistranscampholytic Acid. By William A. Noyes and Edward F. Phillips. *Am. Chem. J.*, **24**, 283–291.—From a study of the

Digitized by Google

action of hydrobromic acid on cistranscampholytic acid, the authors have come to the conclusion that the formula proposed by Blanc and by Bouveault, formula I, for this acid can no longer be considered correct. When cistranscampholytic acid is treated



with hydrobromic acid, it is converted into an acid which in all probability is identical with the acid formed from dihydrohydroxycampholytic acid and hydrobromic acid; for the two bromacids have the same point of fusion and almost identical rotatory power. As this fact cannot be explained on the assumption that formula I is correct, the authors propose formula II for cistranscampholytic acid, and show that by means of it the properties of the acid can be explained. The acid is optically active, although the formula given above does not contain an asymmetric carbon atom. This, according to the authors, is not necessary. By the method of writing the formula "it is intended to indicate that the doubly united carbon atoms no longer lie exactly in the plane of the other three atoms of the ring, but are thrown slightly out of that plane, the one on one side, the other on the other. The carboxyl and methyl groups connected with the same atoms will, in such a case, lie on opposite sides of the ring. A compound of this configuration has no plane of symmetry and may exist in a right-handed and a left-handed form." The rotatory powers of dihydroaminocampholytic acid, dihydrohydroxycampholytic acid, cistranscampholytic acid, and β-bromdihydrocampholytic acid are given.

The Hydrolysis of Acid Amides. By Emmet Reid. *Am. Chem. J.*, 24, 397–424.—The results of the study of the rates of hydrolysis of a number of substituted benzamides with hydrochloric acid and barium hydroxide are given. The experimental methods used were like those employed in an earlier investigation on the same subject (*this Rev.*, 5, 71) and the results obtained are in the main in accord with those already reported. It was found that, with one exception, substituted benzamides having groups in the meta and para positions are hydrolyzed by hydrochloric acid, more slowly than benzamide. With all the groups the nature is of more importance than the weight of the group; *e.g.*, NH_2 retards more than NO_2 or bromine, and almost as much as iodine, when all are in the para position. Groups in the ortho position have a marked retarding influence on the hy-

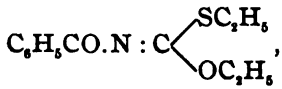
Digitized by Google

drolysis. Iodine, bromine, and chlorine in this position retard the reaction to the extent of 95, 92, and 85 per cent., respectively. The influence of a hydroxyl group is also great, but this is greatly reduced by substituting its hydrogen atom by radicals. At the same concentration barium hydroxide was found to act between five and ten times as fast as hydrochloric acid. The relations between the effects of the position and nature of the substituting groups were, in most cases, about the same with both acid and alkali. A methyl group in the ortho position retarded the action to a very marked degree. An amido group in the para position reduces the velocity of the reaction to less than one-fourth of that of benzamide. In the case of the amides containing the nitro group, or the halogens in the meta or para positions, the results with barium hydroxide were quite different from those obtained with hydrochloric acid. The amides containing the halogens were hydrolyzed two or three times as fast as benzamide, while the nitro group increased the speed of the reaction five and a half times when in the meta position, and six and a half times when in the para position. In the hydrolysis with alkali, the oxybenzamides gave quite abnormal results, the retarding effect being much greater than might have been expected from the experiments in acid solution. This was probably due to the fact that a part of the alkali reacted with the acid hydroxyl and, consequently, did not take part in the hydrolysis. Only about one-half of the theoretical quantity of ammonia could be obtained from *o*-nitrobenzamide, even when it was boiled with strong sodium hydroxide for a number of hours. A red substance was formed as the result of the reaction, which will be investigated further. The derivatives of benzamide which have been studied in this and the previous investigations are those in which the following groups are in the ortho position to the $CONH_2$ group: Cl, Br, I, OH, OCH_3, OC_2H_5, OC_6H_5, NO_2, NH_2, $N(CH_3)_2$, and CH_3; those in which the following groups are in the meta position: Br, I, NO_2, NH_2, CH_3, and OH; and those in which the following groups are in the para position: Cl, Br, I, NO_2, CH_3, NH_2, OCH_3, and OC_2H_5.

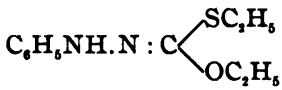
On the Molecular Rearrangement of Disubstituted Thioncarbamic Esters: Phenylimidothiocarbonic Acid Derivatives and Thiosemicarbazidic Esters. By Henry L. Wheeler and Guy K. Dustin. *Am. Chem. J.*, 24, 424–444.—In previous papers it has been shown that monosubstituted thioncarbamic esters, XNH.CS.OR, react with alkyl iodides and give thiol derivatives, XNH.CO.SR. In order to determine whether the rearrangement was dependent on the presence of hydrogen, the disubstituted derivatives were studied, with the result that it was found that in this case a similar reaction took place. In order to determine the extent of the rearrangement, the compounds were

Digitized by Google

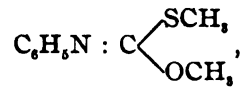
heated with mercuric oxide in alcoholic solution : the disubstituted thion derivatives were readily desulphurized, whereas the corresponding thiol derivatives were unaffected. As the study of the action of reagents upon acylimidothiocarbonic esters, *e. g.*,



and upon anilinoimidothiocarbonic diethyl ester,



had shown that these substances were very reactive, analogous compounds containing the phenylimido group, *e. g.*,

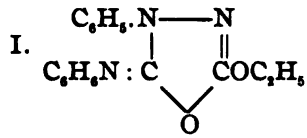


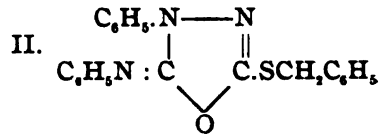
were prepared and studied. These compounds are unreactive with both acyl chlorides and with organic bases, and show a wide departure in their properties from most compounds which contain the imidoester grouping. When, however, the above compound was heated with benzoyl chloride, methyl chloride was slowly given off and a compound of the structure C_6H_5 $C_6H_5CO : N.CO.SCH_3$ was formed. Acetyl chloride reacted with the silver salt of methyl thioncarbanilate in the cold : as a result silver chloride and an acetyl derivative, $CH_3CO.C_6H_5 : N.CS.OCH_3$, were formed. With the object of obtaining a new type of thiocarbamic esters, the behavior of acetyl and benzoylsulphocyanides with ethylphenylthiocarbazinates was investigated. It was found that the thion and thiol esters do not behave alike in this reaction. When acetyl- or benzoylsulphocyanide was mixed with ethyl phenylthioncarbazinate, hydrogen sulphide was evolved, and a very unstable compound was formed. When the corresponding thiol derivative, however, was used, no hydrogen sulphide was evolved and the compounds united directly to form an addition-product. Phenylthioncarbazinic ester forms an addition-product with phenylisocyanate, which has the structure

That the addition takes place to the nitrogen to which the phenyl group is attached, and that the grouping $-NHCS.OC_2H_5$ is present was shown by the behavior of the compounds with alkali and alkyl halides. With methyl iodide and sodium methylate, diphenylurea-imidothiolmethylethyl carbonate was formed. Under

Digitized by Google

the same conditions ethyl iodide gave an analogous compound and a ring-formed compound, which probably has the structure of formula I:





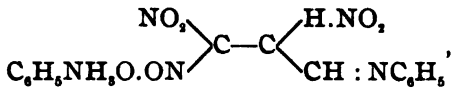
With benzyl chloride but one compound was formed, and this, from the work on its structure as far as it has been carried, appears to have the structure represented by formula II. A study of the action of ethyl chlorcarbonate on some thion and thiol salts of carbonic and carbamic acids showed that no two of these salts behave alike, and that the reaction is very complicated. The preparation and properties of a large number of compounds are fully described.

The Detection of Methyl Alcohol in Mixtures. By S. P. Mulliken and Heyward Scudder. *Am. Chem. J.*, **24**, 444–452.—In a recent article by Jandrier it is stated that the test for methyl alcohol proposed by the authors (*this Rev.*, **5**, 68), based on the oxidation of the alcohol to formic aldehyde, followed by condensation of the latter to a colored derivative of resorcin, is unreliable, because it is also given by acrolein and is interfered with by the presence of furfurol. To remedy these defects Jandrier recommended the use of gallic acid in place of resorcin as the reagent for formic aldehyde. A careful examination by the authors of this modification of their test proved that its use is entirely inadmissible, notwithstanding the fact that gallic acid is a better reagent for formic aldehyde than is resorcin. Experiments showed that a great many compounds besides methyl alcohol gave traces of formic aldehyde when oxidized by means of hot copper oxide. It was impossible to distinguish these compounds from methyl alcohol and its simple derivatives when gallic acid was used, but that this could be done when resorcin was used, as it is a less sensitive reagent for the aldehyde. Detailed directions are given for carrying out the test when the alcohol is mixed with other substances.

On Some Derivatives of α-Nitro-β-dinitropropionic Aldehyde. By Joseph Torrey, Jr., and Otis Fisher Black. *Am. Chem. J.*, **24**, 452–465.—The authors have carefully studied the orange-red potassium salt obtained by Hill and Sanger (*Ber. d. chem. Ges.*, **15**, 1906) by the action of potassium nitrite on mucobromic acid, and have come to the conclusion that the substance is the dipotassium salt of α-nitro-β-dinitropropionic aldehyde. This conclusion was reached as the result of the study of the action of aniline on the compound, and from its conversion into

Digitized by Google

nitromalonic aldehyde. The compounds described are of unusual interest, as they do not closely resemble other nitro compounds in the fatty series. They are unusually stable, and the free nitro compounds can be readily obtained from their salts by acidification. When the orange-red salt mentioned above was treated with aniline acetate, it was converted into the aniline salt of α-nitro-β-dinitropropionic anil,



which decomposed at 84°–86°. This salt was decomposed by potassium hydroxide, and the dipotassium salt of the anil was formed, from which the free anil, $CH(NO_2)_2.CH(NO_2).CH : NC_6H_5$, decomposing at 90°, was obtained by precipitation with strong acids. By boiling the anil with alcoholic potash the phenylimide group was replaced by oxygen, and the original dipotassium salt of α-nitro-β-dinitropropionic aldehyde was obtained. This compound was converted by heating with water or alcohol into potassium nitromalonic aldehyde. The reaction which takes place when the dipotassium salt is treated with three molecules of aniline and an excess of hydrochloric acid is additional proof of the structure here put forward. Under these conditions there is produced, quantitatively, one molecule of nitromalonic aldehyde anil and two molecules of benzene diazonium chloride, which are formed from the aniline and the two nitro groups eliminated from the trinitropropionic aldehyde. Methylamine and *p*-toluidine were found to react like aniline with the nitroaldehyde, and a number of the resulting compounds are described.

On Paranitroorthotolylphenylsulphone and Some of Its Derivatives. By R. S. Norris. *Am. Chem. J.*, **24**, 469–491.—It has been shown by Hollis (*this Rev.*, **6**, 96) that, when the chloride of *p*-nitro-*o*-sulphobenzoic acid is treated with benzene and aluminum chloride, but one of the chlorine atoms is replaced by a phenyl group. As the product of the reaction is readily converted into an acid by heating with water, it must have one of the two following formulæ :

The work described in the present paper was undertaken to determine which of these formulæ is correct. A substance of the structure represented by formula 1, was prepared by a synthesis which left no doubt as to its constitution, and was found not to be identical with the compound described by Hollis, which must, therefore, have the structure given in formula 2. *p*-Ni-

Digitized by Google

tro-*o*-toluenesulphone chloride (m. p. 44°) was converted by means of benzene and aluminum chloride into the corresponding sulphone (m. p. 158°) which, in turn, was oxidized to *p*-nitro-*o*-phenylsulphonebenzoic acid, $C_6H_3(NO_2)4,(SO_2.C_6H_5)2,(COOH)1$. This acid does not resemble the acid obtained from the chloride made by Hollis. It is difficultly soluble in water, melts at 196°, and forms well-characterized barium and calcium salts, which have one molecule and six and one-half molecules of water, respectively. This acid was converted into its chloride, which must have the structure given in formula 1 above. The chloride melted at 109°, whereas the chloride obtained by Hollis melted at 177°; the latter must, therefore, have the structure of formula 2. As additional evidence, an attempt was made to condense *p*-nitro-*o*-cyanbenzenesulphone chloride with benzene, with the intention of saponifying the resulting nitrile, which would thus give, by a different synthesis, *p*-nitro-*o*-phenylsulphonebenzoic acid. It was found, however, that the presence of the cyan group prevented the condensation by means of the Friedel and Crafts reaction. In connection with the work the following-named substances were prepared: a sulphonic acid from *p*-nitro-*o*-tolylphenylsulphone, the barium salt of which was analyzed; *p*-amido-*o*-tolylphenylsulphone (m. p. 156°); and *p*-nitro-*o*-phenylsulphonebenzamide (m. p. 191°–192°).

Derivatives of Phenyl Ether. By A. N. Cook and H. W. Hillyer. *Am. Chem. J.*, **24**, 525–529.—2-Nitro-4′-methylphenyl ether, $NO_2.C_6H_4.O.C_6H_4.CH_3$, prepared from *o*-bromnitrobenzene and potassium cresolate, melts at 49°, boils at 220° at 25 mm. pressure, and is converted into 2-nitrophenylether-4′-carbonic acid, $NO_2.C_6H_4.O.C_6H_4.COOH$, when oxidized by chromic acid. This acid melts at 182°–183° and gives insoluble salts with most of the heavy metals. 2-Amino-4′-methylphenyl ether is unstable, but forms a hydrochloride, which melts at 220°, and a chlorplatinate, which contains one and one-half molecules of water and melts at 150°.

A Further Investigation of the Symmetrical Chloride of Paranitroorthosulphobenzoic Acid. By W. E. Henderson. *Am. Chem. J.*, **25**, 1–26.—By a slight modification of the method of Remsen and Gray (*this Rev.*, **3**, 155) the symmetrical chloride of *p*-nitro-*o*-sulphobenzoic acid (m. p. 98°) was obtained in pure condition, with an average yield of 40 per cent. of the theoretical quantity. The compound forms large monoclinic crystals, which were measured. When the chloride was treated with benzene and aluminum chloride, but one chlorine atom was replaced by the phenyl group. The resulting compound—*p*-nitro-*o*-benzoylbenzenesulphone chloride (m. p. 177°)—was identical with the product obtained from the unsymmetrical chloride under the same circumstances. The chloride was converted into an acid, of

Digitized by Google

which the barium salt was prepared. This salt has been shown by Hollis (*this Rev.*, **6**, 96) to unite with different quantities of water of crystallization, under varying conditions. It is shown by the author that if the solution of the salt is boiled with bone-black and all coloring-matter is removed, but one hydrate, which contains 7 molecules of water, can be formed. With methyl and ethyl alcohols the chloride yielded the acid esters of *p*-nitro-*o*-sulphobenzoic acid. With ethyl alcohol the unsymmetrical chloride was converted into the chloride of the acid ethyl ester of the sulphobenzoic acid. With phenols the symmetrical chloride gave two series of derivatives. With monohydroxyphenols both esters and sulphophthaleïns were formed, the former being produced in larger quantities. The esters prepared from phenol, *o*-cresol, and *p*-cresol melted at 119°, 90°, and 117°, respectively. With polyhydroxyphenols no esters were obtained, but compounds of the unsymmetrical type, usually containing more than two phenol residues, were formed. When the chloride and aniline were brought together in chloroform solution, the symmetrical anilide (m. p. 222°) and the anil (m. p. 183°) were formed. In ethereal solution, in the presence of potassium carbonate, but one anilido group was introduced. The resulting acid was converted into its barium salt, which was analyzed. By the action of phosphorus oxychloride the anilide was converted, by loss of one molecule of water, into a dianil (m. p. 208°). This dianil is changed by glacial acetic acid into an unsymmetrical anilide, which does not melt or decompose at 340°. When heated with hydrochloric acid, aniline was split off and the anil was formed.

The Action of Sulphuric Acid on Phenetol. By William B. Schober and Henry L. Bowers. *Am. Chem. J.*, **25**, 69–77.—Phenetol was heated with concentrated sulphuric acid under varying conditions of concentration, time of heating, and temperature. *p*-Phenetolsulphonic acid was formed in every case when the reaction took place at temperatures varying from 21° to 90°. The amount of the acid which was isolated, decreased the longer the substances were heated at 90°. The best yield was obtained when equal weights of sulphuric acid and phenetol were heated at 90° for thirty minutes. From 15 grams of phenetol 16.5 grams of the *p*-sulphonamide were obtained. *m*-Phenetolsulphonic acid was formed in small quantities in most of the experiments. A minute quantity of the disulphonic acid was produced when phenetol was heated at 85°, for thirty minutes with fuming sulphonic acid.

On Triphenylchlormethane. By James F. Norris and Warren W. Sanders. *Am. Chem. J.*, **25**, 54–62.—When a carbon disulphide solution of carbon tetrachloride and benzene in the proportions of one molecule of the former to four molecules of the latter was treated with aluminum chloride, care being taken

Digitized by Google

to prevent a rise in temperature, a reaction took place, which was complete in twenty-four hours. As the result, a well-crystallized compound of the formula $Al_2Cl_6.2(C_6H_5)_3CCl$ was formed. This compound was decomposed by water, and when the temperature was kept at 0°, 97 per cent. of the theoretical yield, calculated from the carbon tetrachloride used, was obtained. In an attempt to make tetraphenylmethane, an ethereal solution of triphenylchlormethane and brombenzene was treated with sodium. Among the products of the reaction was a substance which resembled closely triphenylmethyl peroxide, which has recently been described by Gomberg (*this Rev.*, 7, 6). The authors propose to investigate the action of sodium on triphenylchlormethane, as preliminary experiments indicated that under certain circumstances these substances react, notwithstanding the fact that previous observers have found that they do not react.

On Triphenylchlormethane. By M. Gomberg. *J. Am. Chem. Soc.*, 23, 109–110.—The author calls attention to the fact that his work on triphenylchlormethane, which has been recently published (*this Rev.*, 7, 6), was probably completed before the work mentioned in the preceding review was begun. As stated above, Norris and Sanders found that sodium reacted with triphenylchlormethane. The author, in an earlier investigation, found that no reaction took place when these substances were brought together in benzene solution, and now expresses a regret that Norris and Sanders propose to investigate the subject farther, as he is continuing his investigations on triphenylmethyl.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. Talbot, Reviewer.

The Composition and Analysis of London Purple. By J. K. Haywood. *J. Am. Chem. Soc.*, 22, 800–810.—Procedures are described for the determination of moisture, total arsenious and arsenic acids, total calcium, and also for soluble arsenious acid and soluble calcium, and "other inorganic matters." The author concludes that the arsenic and arsenious acids and calcium are usually combined as normal calcium arsenite and arsenate in the London purple, but that compounds corresponding to the symbols $CaHAsO_3$ and $Ca_2As_2O_5$ are occasionally present.

Kilgore's Modification of the Volumetric Method of Estimating Phosphoric Acid. By C. B. Williams. *J. Am. Chem. Soc.*, 23, 8–12.—The author finds the Kilgore procedure highly satisfactory, on the side of both rapidity and accuracy. The procedure is described in detail.

Digitized by Google

A Method of Preparing Normal, Seminormal, Decinormal, Etc., Sulphuric Acid of Exact Strength. By RICHARD K. MEADE. *J. Am. Chem. Soc.*, 23, 12–15.—Pure, crystallized copper sulphate is dissolved in water, and the copper deposited upon a cathode of copper foil. The resulting solution of sulphuric acid, which was found to be free from copper after being subjected to a current of 1.5 amperes for eight hours, is diluted to the required volume.

Soluble Arsenious Oxide in Paris Green. Preliminary Report. By S. AVERY AND H. T. BEANS. *J. Am. Chem. Soc.*, 23, 111–117.—The authors find that the term "soluble arsenious oxide" as applied to Paris green is of doubtful significance, since the material, especially in a finely divided condition, undergoes hydrolysis when suspended in water, as a result of which arsenious acid passes into aqueous solution, the amount increasing to a maximum with the time of exposure. This point is assumed to represent a state of equilibrium, but it is only reached after weeks of standing. Carbon dioxide is found to greatly promote the decomposition of the Paris green, and this constituent of the atmosphere may very well, under certain atmospheric conditions, cause a fair sample of the insecticide to exhibit the properties of a sample containing much more than the four per cent. of "soluble arsenious acid," which is fixed upon as a maximum allowable quantity by Hilgard and others. Compare *this Rev.*, 6, 168, and 7, 34.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. CROSBY, REVIEWER.

The Analyses of Italian Volcanic Rocks. By H. S. WASHINGTON. *Am. J. Sci.*, 159, 44–54.—Analyses are given of the following types of rocks: Ciminite, from Monte Cimino, Viterbo; Mica Trachyte (selagite), from Monte Catini, Tuscany; Andesite, Radicofani, Tuscany; Leucitite, from Capodi Bove, Alban Hills. A discussion is made of the analyses, the mineralogical composition of the rocks, and their classification in accordance therewith.

Occurrence of Native Lead with Copper and Other Minerals at Franklin Furnace, N. J. By W. M. FOOTE. *Am. J. Sci.*, 156, 187–188.—Small irregular masses of lead, 1 to 2 mm. in diameter, associated intimately with native copper and a variety of minerals—among them axinite, garnet, willemite, and phlogopite—have been found on a few specimens taken from the 800-foot level of the Parker shaft on North Mine Hill. The rarity of native lead and its associations at Franklin make the discovery interesting.

Digitized by Google

Occurrence of Sperrylite in North Carolina. By W. E. Hidden. *Am. J. Sci.*, **156**, 380–381.—The mineral sperrylite—a diarsenide of platinum—is described from Macon County, N. C., where it was discovered in the sands of Cowee Creek, associated with a little gold and the minerals monazite, zircon, and menaccanite. The sperrylite consisted of a few very minute, nugget-like particles and crystals, the latter showing the combination of the cube and octahedron.

Thomsonite, Mesolite, and Chabazite from Golden, Colorado. By Horace B. Patton. *Geol. Soc. Am.*, **17**, 461–474; plates, 43–49.—The paper gives a detailed description, supplemented by excellent plates, of the occurrence and habits of the above-named zeolites, found in a scoriaceous band of the basalt flow which caps what is known as Table Mountain, near Golden.

Reconnaissance of the Gold Fields of Southern Alaska, with Some Notes on General Geology. By George F. Becker. *U. S. Geol. Survey, Ann. Rep.*, **18**, *Part 3*, 1–86.—The active or recently active, Alaskan volcanoes are described at some length. The most modern methods are applied in the distinction of the feldspars in the Alaskan rocks; and the petrographic descriptions are accompanied by numerous chemical analyses, chiefly by Hillebrand, including the Alaska-Treadwell syenite, Karluk diorite, pyroclastic diorite, gabbro, andesite, dacite, and other lavas.

Geology of the Yukon Gold District, Alaska. By Josiah Edward Spurr. *U. S. Geol. Survey, Ann. Rep.*, **18**, *Part 3*, 87–392.—This long paper, with an historical introduction by Harold B. Goodrich, is the most complete and elaborate account of the geology, both theoretic and economic, of the famous Klondike region, which has yet appeared. The geological formations, both sedimentary and eruptive, are described in great detail, but the descriptions are not accompanied by analyses. Following this section is an important chapter on the movements in the earth's crust, after which the modes of occurrence of the valuable metals in solid rocks are described and discussed, with some assays and other chemical notes. The interest of this chapter culminates in the section on the genesis of auriferous quartz veins, in which the author accepts the view of a perfect gradation between veins and igneous rocks, recognizing pegmatite as a true intermediate type, the product of the equal cooperation of heat and water. The various theories of rock differentiation are discussed; the source of the gold is found in the igneous rocks, in which, however, because of the viscosity of the magmas, it fails of concentration; but in passing from igneous through aqueo-igneous to aqueous conditions the magmas become progressively more fluid; and the auriferous quartz vein is thus shown to be the normal final product, or the end term of the lithologic series. The important chap-

Digitized by Google

ter on the placer deposits discusses the origin of the placer gold, only to accept its mechanical derivation from the rock formations and to reject the hypothesis that it is due in any appreciable degree to chemical deposition in the gravels. The brief account of coal in the neighborhood of the gold belt contains two partial analyses by H. N. Stokes, which show the coals to be hard lignites.

Some Coal Fields of Puget Sound. By Bailey Willis. *U. S. Geol. Survey, Ann. Rep.*, **18**, *Part 3*, 393–436.—This paper is essentially stratigraphic and structural, with no details as to the composition or chemical relations of either the coals or the associated rocks.. It is stated in the introduction, however, that the coals vary from lignites containing: moisture 8 to 12, volatile hydrocarbons 35 to 45, and fixed carbon 30 to 45 per cent., to bituminous lignites or steam coals, in which the moisture is reduced to 5 per cent. or less, and the fixed carbon ranges from 40 to 50 per cent., or to bituminous coking coals containing moisture 1 to 3, volatile hydrocarbons 25 to 35, fixed carbon 50 to 60 per cent. The ash of these coals is frequently as much as 10 per cent.

Geology and Mineral Resources of the Judith Mountains of Montana. By Walter Harvey Weed and Louis Valentine Pirsson. *U. S. Geol. Survey, Ann. Rep.*, **18**, *Part 3*, 437–616. —The elaborate stratigraphic and structural sections making up the main part of this paper are followed by a chapter by Pirsson on the igneous rocks, which embrace only a few acid types of simple mineral composition, belonging to the granite, syenite, and phonolite families. For the tinguaites of the phonolite family eight analyses are quoted, from which the mineral composition is deduced. The chapter on dynamic and structural geology discusses the forms and origin of the laccolites, in which the igneous rocks chiefly occur, and the concluding chapter on the mineral resources notes that the ores are chiefly gold, original tellurides now altered by oxidation, with fluorite as a prominent gangue mineral, and with a general resemblance to the Cripple Creek deposits. The paper closes with four analyses of the Judith Mountain Coals, which are shown to belong to the splint and cannel varieties and to be of excellent quality.

A Geological Sketch of San Clemente Island. By William Sidney Tangier Smith. *U. S. Geol. Survey, Ann. Rep.*, **18**, *Part 2*, 459–496.—San Clemente is built up almost entirely of lava flows, with intercalated volcanic breccias and ash deposits. The prevailing volcanic is normal pyroxene-andesite, ranging in chemical composition from basic to acid. But the youngest lavas include dacite and rhyolite, containing, respectively, 67 and 70 per cent. of silica. Four analyses, two by the author and two by

Digitized by Google

W. O. Smith, give the composition of the rhyolite and dacite, and less completely of two types of the andesite, one with and the other without iddingsite. The analyses are not discussed.

The Mining Districts of the Idaho Basin and the Boise Ridge, Idaho. By WALDEMAR LINDGREN. *U. S. Geol. Survey, Ann. Rep.*, 18, *Part 3*, 617–719.—The ores in which gold values predominate are only in part free milling; and they all occur in granite or associated dikes. The granite country rock is extensively altered in the vicinity of the veins, and two analyses by George Steiger, of fresh and altered material, show the degree and character of the alteration, in which atmospheric agencies have played no part. From the analyses the mineral compositions are deduced, and a comparison of these is very instructive, as showing how comparatively slight chemical changes may correspond to a mineralogical revolution, the complete replacement of the original biotite and feldspars by sericite being the most striking feature of the change. The detailed descriptive chapters embody some assays of the ores, and data with regard to the fineness of the gold are given for each district.

Preliminary Report on the Mining Industries of the Telluride Quadrangle, Colorado. By CHESTER WELLS PURINGTON. *U. S. Geol. Survey, Ann. Rep.*, 18, *Part 3*, 745–848.—The chemistry of this paper begins with the chapter on the ore, in which a list of the ore and gangue minerals and their distribution is followed by descriptions with notes upon the composition and origin of the species. The distribution of the ores and minerals in the veins, the manner of deposition, the influence of the country rock on the values in the veins, the origin of the ore, the age of the deposits, surface alteration, water-level, and the auriferous impregnation of Silver Mountains, are important sections for the student of ore deposits and chemical geology. They embrace several miscellaneous analyses.

The Slate Belt of Eastern New York and Western Vermont. By T. NELSON DALE. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 3*, 153–307.—This is a very complete and well illustrated paper on one of the most important slate districts of North America. Although it is, necessarily, in the main, a structural and economic study, the fine series of exhaustive analyses, chiefly by W. F. Hillebrand, make this a very notable contribution to the chemistry of the roofing slates. The analyses, some twenty in number, and consisting, each, of from twenty to twenty-five determinations, include especially the "sea-green," "unfading green," purple and variegated, red, bright green, and black slates, and the green spots in the red slates. In addition, nine analyses are quoted for the slates of other regions. The chemical constituents of the roofing slates are shown to be referable to about ten dis-

Digitized by Google

tinct minerals. The paper closes with an appendix by Hillebrand, discussing especially the fading of some of the green slates, which he attributes mainly to the solution of a complex carbonate of calcium, magnesium, manganese, and iron. This carbonate is shown to be the most variable constituent of the slates, and the elimination of this, together with the apatite and pyrite, from the analyses makes them much more accordant. The green spots in the slates are shown to be richer in this complex carbonate, silica or quartz, pyrite, rutile, and tourmaline than the surrounding slates, and poorer in hematite, and to be unquestionably due primarily, as hitherto supposed, to the reducing action of decaying organic matter upon the ferric oxide.

The Coos Bay Coal Field, Oregon. By J. S. Diller. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 3*, 309–376.—This is almost exclusively a structural study; but the author gives us, without discussion, thirty-two analyses of the coals, chiefly by George Steiger; and the supplementary chapters by William C. Day on the coal and pitch coal of the Newport Mine gives additional analytical results, from which the author concludes that the pitch coal has been formed after the manner of asphalts and that it is a true asphalt.

The Titaniferous Iron Ores of the Adirondacks. By James Furman Kemp. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 3*, 377–422.—Upon the study embodied in this paper was based the author's review of the titaniferous magnetites of the world, previously noticed in this Journal. We here find the New York ores more fully considered, with detailed descriptions of the ore formations and mines, and maps and other illustrations; but the analyses, nearly forty in number, and the chemical discussion are essentially the same.

Geology of the McAlester-Lehigh Coal Field, Indian Territory. By Joseph A. Taff. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 3*, 423–456.—The carboniferous strata of this district form a series of rather deep synclinal folds or basins and the two productive coal beds occur in the McAlester shale, which has a thickness of 2,000 feet. The Hartshorne coal is at the base of the shale and the McAlester coal is 700 feet below the top of the shale, 1300 feet of coal separating the two seams, each of which averages about four feet in thickness. The coals of this field are all highly bituminous, the volatile matter being in no instance less than 37 per cent., and the fixed carbon averaging about 52 per cent. The moisture is low, averaging about 2 per cent., and the sulphur and ash are rarely excessive. Five proximate analyses by W. F. Hillebrand are given.

Iron Ores. By John Birkinbine. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 23–63.—This annual statistical account, or sum-

Digitized by Google

mary of exploitation and production, of the iron ores of the United States for 1897 embodies a few new analyses. These include one analysis of the shipping ore of the Tilly Foster Mine, one analysis of the raw ore of the Cornwall Mine, nearly two hundred analyses of the Lake Superior ores from the Gogebic, Marquette, Menominee, Mesabi, and Vermilion ranges, and three analyses of the Red Mountain ores of Alabama.

Manganese Ores. By JOHN BIRKINBINE. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 91–125.—This is a general account for 1897 of the manganese ores of the world. The analyses are a very secondary feature; but five analyses are given of the ore mined near Vesuvius, Virginia, one analysis of a French ore, two of Russian ore, one of a Spanish ore, and four of Japanese ores.

Asphaltum. By EDWARD W. PARKER. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 187–204.—This general account of the domestic production and imports of asphaltum for 1897 contains two analyses of the asphaltum from the mines of Santa Barbara and Ventura Counties, California.

Stone. By WILLIAM C. DAY. *U. S. Geol. Survey, Ann Rep.*, 19, *Part 6*, 205–309.—This somewhat elaborate account of the production of building and decorative stones in the United States for 1897 fairly bristles with the results of tests and analyses. Among the stones of which numerous analyses are given are granite, trap, marble, slate, sandstone, limestones, and lime, all of these being represented by specimens from a large number of localities.

The Kaolins and Fire Clays of Europe. By HEINRICH RIES. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 377–467.—This paper is crowded with analyses, mainly quoted but partly new, and in part of American materials for comparison with the foreign.

The Clay-Working Industry of the United States in 1897. By HEINRICH RIES. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 469–489.—This brief review of a great industry is chiefly chemical, embodying more than one hundred and fifty analyses, a large proportion of which had not been previously published.

Portland Cement. By SPENCER B. NEWBERRY. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 487–494.—The only original chemical contribution in this paper is an analysis of a nearly pure calcareous marl from Syracuse, Indiana, which it is proposed to use for cement manufacture on a large scale.

Abrasive Materials. By EDWARD W. PARKER. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 515–533.—The descriptions of new occurrences and the statistics of production of the various abrasives are supplemented, in the case of pumice, by five analyses of pumice from Utah and Nebraska.

Digitized by Google

Phosphate Rock. By DAVID T. DAY. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 535–556.—Five new analyses by L. P. Brown of the phosphate rock of Tennessee are given, with one analysis for comparison of the unaltered limestone from which the phosphate rock is derived by differential erosion—solution of the calcium carbonate.

Memorandum on the Mineral Resources of the Philippine Islands. By GEORGE F. BECKER. *U. S. Geol. Survey, Ann. Rep.*, 19, *Part 6*, 687–693.—This paper consists of very brief notes on coal, gold, copper, etc.; and for the coal, which is supposed to be all of Tertiary age, and is described as a highly carbonized lignite, a single analysis is given, showing: water, 13.52; volatile matter, 37.46; fixed carbon, 44.46; ash, 4.56; total, 100.00 per cent.

The Gold and Silver Veins of Silver City, De Lamar and Other Mining Districts in Idaho. By WALDEMAR LINDGREN. *U. S. Geol. Survey, Ann. Rep.*, 20, *Part 3*, 75–256.—This economic monograph supplements that in the Eighteenth Annual Report on Boise Ridge and Idaho Basin, the chief igneous rocks, besides the Columbia volcanics, are the granites, of which four complete analyses are given. The analyses are also recalculated to show the molecular proportions of the constituents and the probable mineralogical composition. The quartz (28 to 29 per cent.) is regarded as too low for a normal granite, and the ratio of the soda-lime to the potash feldspar (3 : 1) too high. Accordingly, while retaining "granite" as a general designation, the author assigns the rock a position between the granodiorites and the quartz-monzonites. Passing to the mineral deposits, the filling of the fissures by ascending thermal solutions is regarded as proved by compact siliceous spring deposits with vegetable remains and containing gold and silver; and especially by the alteration of the wall rock. Impregnation and replacement of the wall have not, in general, however, yielded much ore of working grade. Many different types of veins are recognized in the district, and the mineralogical and other characters of each are indicated. The detailed descriptions of the mines include many assays and analyses of the ores and associated gangues and country-rocks. Of special interest among the gangue materials is orthoclase, which, although of rare occurrence in metalliferous veins, is a prominent feature of some of the veins at Silver City. The analysis shows it to be a very pure potash feldspar. It belongs to the variety adularia; but to distinguish orthoclase in the gangue from that in the wall-rock the author proposes for the former Breithaupt's old name *valencianite*. The alteration of the wall-rocks—granite, basalt, rhyolite, etc.—by hydrothermal action is discussed at length, with numerous complete analyses.

Digitized by Google

The chemical work embodied in this monograph has been done chiefly by Messrs. Hillebrand, Stokes, and Steiger.

Geology of the Little Rock Mountains, Montana, with Notes on the Mineral Deposits of the Neikart, Barker, Yogo, and Other Districts. By WALTER HARVEY WEED. *U. S. Geol. Survey, Ann. Rep.*, 20, *Part 3*, 257–461.—This is another elaborate economic monograph; but unlike the preceding paper, it embodies but little chemical work; and the only thing demanding special mention is an analysis of a complex carbonate, which is probably a mixture of rhodocrosite and ankerite. It occurs abundantly as a part of the gangue of the Neikart veins.

Petrography of the Igneous Rocks of the Little Belt Mountains, Montana. By L. V. PIRSSON. *U. S. Geol. Survey, Ann. Rep.*, 20, *Part 3*, 463–581.—This monograph supplements the preceding, and includes the chemical analyses and discussions properly belonging to a complex petrographic study. The numerous analyses, partly original, by Hillebrand, the author, and others, and partly quoted for comparison, embrace syenites, monzonites, diorites, granite-syenite-aplite, granite-porphyry, syenite-porphyry, diorite-porphyry, diorite-syenite-porphyry, rhyolite, minettes, analcite-basalts, and lamprophyres. These rocks occur chiefly in the form of laccoliths, and an attempt is made, by generalizing the chemical and mineralogical composition of the six principal laccoliths, to throw some light upon the genetic or magnetic relations of the rocks. Individually, the laccoliths are not differentiated, which is accounted for by the acidity and viscosity of the magma at the time of its intrusion. Chemical composition is found to be a much more important factor than depth in determining the texture or grain of the rocks. A similar study of the stocks and massives shows, in one instance (Yogo Peak), a marked radial differentiation, so that we pass outward from a center of acid syenite through intermediate types to a periphery of shonkinite, a very basic rock. The nature and cause of this gradation are discussed; and the aplitic dikelets intersecting the basic exterior are shown to find a ready explanation in the injection of shrinkage cracks by the magma residuum.

Iron Ores. By JOHN BIRKINBINE. *U. S. Geol. Survey, Ann. Rep.*, 20, *Part 6*, 27–59.—This general statistical account of the exploitation and production of iron ores in the United States in 1898 embodies about one hundred and fifty complete cargo analyses of the Lake Superior ores, including the Gogebic, Marquette, Menominee, Mesabi, and Vermilion ranges. The analyses of the ores in their natural state gave percentage results which are summarized as to metallic iron and water as follows:

Digitized by Google

Range.	Iron.	Moisture.
Marquette	66.8 to 39.26	0.43 to 16.68
Menominee	60.62 " 39.46	2.51 " 11.00
Gogebic	60.56 " 44.83	8.24 " 14.34
Vermilion	66.67 " 55.06	1.04 " 8.38
Mesabi	60.77 " 51.50	6.94 " 12.54

This summary shows that comparatively few Lake Superior ores contain in their natural state 60 per cent. or more of metallic iron, and that the richer ores are practically confined to the Marquette and Vermilion ranges, where some ores approach 67 per cent. of iron. But the ores are marketed upon analyses made after drying at 212° F., and comparatively few are shipped which show on this basis less than 60 per cent. of metal. The leaner ores indicated by the minima of the table have some special value, either because of very low phosphorus content, the manganese they carry, or, because being highly siliceous and cheaply mined, they form desirable mixtures with low silica ores. The concluding section, on the Montana iron ores, contains several analyses of the ores of prospective iron mines on Judith and Fox mountains.

Manganese Ores. By JOHN BIRKINBINE. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 6*, 125–158.—This paper, like the preceding, is a summary of discovery, exploitation, and production for 1898; but three analyses are given of Lake Superior manganiferous iron ores, showing from 4.50 to 7.40 per cent. of manganese; eight analyses of manganese ores from Santiago, Cuba; five analyses of manganese ores from Chili; and the paper concludes with a summary of the mineralogical and chemical characteristics of manganese ores.

Asphaltum and Bituminous Rock. By EDWARD W. PARKER. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 6*, 251–268.—This annual statistical summary of the exploitation and production of asphaltum for 1898 contains the results of an investigation by William C. Day, of a new solid asphalt from Utah, known as nigrite on account of its intensely black color. The nigrite forms a fissure vein and is said to bear no relation, geologically or otherwise, to the small deposits of ozocerite found in the vicinity. In its mode of occurrence it resembles gilsonite and wurtzilite, but has none of the vulcanite qualities of the latter nor the pitchy, easy fluxing character of the former. Three analyses are given, showing the proportions of volatile matter, fixed carbon, and ash, and also of carbon, hydrogen, nitrogen, and sulphur, and the solubilities in various solvents. Nigrite differs from all other asphalts in grinding to a shining black instead of a dull brown powder. Its solubility is low and it cannot be entirely melted. The volatile matter is high, but less volatile than for ordinary asphalts. The theory that nigrite was formed by distillation,

Digitized by Google

that is, by the passage of steam through an oil, thus depriving it of the most volatile constituents, while subsequent heating of the residue converted it into the nigrite, as found, is fully confirmed by experiments.

Stone. By William C. Day. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 6*, 269–464.—This is the annual statistical summary of the exploitation and production of building and decorative stones, for 1898; but much more attention is given than usual to the chemical composition of the stones. The numerous analyses are mainly quoted, but a few are new. They include Hillebrand's very elaborate analyses of the slates of Eastern New York and Western Vermont, and nine analyses of the slate of other regions, and then follows, in the alphabetical order of the states, a résumé of pretty much all that has been done in the way of analyses and chemical and physical tests of the stones of this country, constituting a storehouse of data, which should be widely known and used.

Fuller's Earth. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 6*, 741–743.—Accompanying the statistics of the production for 1898 are analyses of fuller's earth from Ocala, Florida, and Valentine, Nebraska.

Mineral Resources of Porto Rico. By Robert T. Hill and H. B. C. Nitze. *U. S. Geol. Survey, Ann. Rep.*, **20**, *Part 6*, 771–787.—The descriptions of the economic products are supplemented by analyses, in part new, of mineral waters, iron ore, and copper ore.

Geology and Mining Industry of the Tintic District, Utah. By George Warren Tower, Jr., and George Otis Smith. *U. S. Geol. Survey, Ann. Rep.*, **19**, *Part 3*, 601–767.—This important and elaborate economic monograph of one of the oldest mining districts of the west, embodies analyses by H. N. Stokes and George Steiger of the principal sedimentary and igneous rocks of the region, including the Eureka and Godiva limestones, in which the ore bodies occur, and the Hamburg series of impure limestones and sandstones, all of carboniferous age, though resting directly upon the Robinson (Cambrian) quartzite, and including also rhyolites, quartz porphyry, andezite, and monzonite among the igneous rocks. The metamorphism and weathering of the rocks are briefly discussed; and the character of the ore-bearing solutions, the origin of the metals and gangue, and the secondary changes in the ores, are considered. In the descriptions of the ore deposits the most notable features are the mineralogical complexity, embracing about fifty species, and the analyses, chiefly by Hillebrand, of the truly remarkable series of copper arsenates, sulphates, etc., for which the Tintic district is famous.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 5.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

F. J. MOORE, REVIEWER.

The Iodometric Estimation of Arsenic Acid. BY F. A. GOOCH AND JULIA C. MORRIS. *Am. J. Sci.*, **160**, 151–157.—Solutions of arsenates are reduced by soluble iodides with separation of iodine. As the reaction is a reversible one, it is necessary, for analytical purposes, to eliminate the oxidizing effect of the liberated iodine. Gooch and Browning (*Am. J. Sci.*, **50**, 66) accomplished this by boiling off the iodine. The same result would be effected by changing the iodine to hydriodic acid by means of sodium thiosulphate. An attempt to base an analytical procedure upon this principle was made by Williamson (*J. Soc. Dyers and Colorists*, *1896*, 86–89). According to Williamson, the arsenic acid could be measured either by the amount of thiosulphate required to bleach the solution, or, after the reduction, the arsenious acid formed could be again oxidized by iodine. If the thiosulphate method is used the titration must be made in a strongly acid solution. This introduces an error on account of the tendency of the hydriodic acid to oxidation in the presence of strong acids, and also because the thiosulphate added is liable to be decomposed before it can react with the iodine. The authors find that when this method is used a correction of —0.003 gram must be applied to each determination of arsenic acid. If the arsenite is oxidized by iodine, the arbitrary correction necessary is reduced to 0.0015 gram. The authors consider both methods inferior to that of Gooch and Browning.

The Volumetric Estimation of Copper as the Oxalate with Separations from Cadmium, Arsenic, Tin, and Zinc. BY CHARLES A. PETERS. *Am. J. Sci.*, **160**, 359–367.—Copper may be completely precipitated as oxalate in solutions containing the

Digitized by Google

above metals. The precipitated oxalate is then filtered off on asbestos and titrated with permanganate in the presence of sulphuric acid. The essentials for complete precipitation are a large excess of oxalic acid and the presence in the solution of a certain minimum amount of copper depending in each case upon the volume of the solution and the concentration of the oxalic acid. Thus in a solution containing 0.064 gram copper in 50 cc., the copper will be completely precipitated by a gram of oxalic acid. By adding oxalic acid to the point of saturation, the minimum amount of copper required for the same volume of solution is reduced to 0.012 gram.

The Sulphocyanides of Copper and Silver in Gravimetric Analysis. By R. G. Van Name. *Am. J. Sci.*, **160**, 451–457.—The literature contains conflicting statements concerning the practicability of determining copper by direct weighing of cuprous sulphocyanate. The author finds the method satisfactory. The copper solution is first reduced with ammonium bisulphite and then precipitated by ammonium sulphocyanate. The precipitate is filtered off on a Gooch crucible, and weighed after drying at 110°. Contrary to the statements of some writers, the precipitate does not retain water at this temperature. As the sulphocyanate of silver is soluble in an excess of ammonium sulphocyanate, this method cannot be used for the determination of silver, but as the precipitate is insoluble in an excess of silver nitrate it may well be made use of for standardizing sulphocyanate solutions for use in the Volhard method.

Method for Graphite in Pig Iron. By A. B. Harrison. *Proc. Eng. Soc. Western Pa.*, **16**, 117–118.—One gram of pig iron is dissolved in nitric acid of 1.13 specific gravity, and the solution is boiled till red fumes are no longer expelled. Two filters are accurately tared and the residue is filtered off, after diluting the solution, which is allowed to run through both filters. The filters are washed successively with nitric acid, water, ammonia, alcohol, and ether, and are dried and weighed. The filter containing the graphite is then ignited, and the weight of the ash is deducted from the difference between the final weights of the two filters.

Analysis of Chrome and Tungsten Steels. By A. G. McKenna. *Proc. Eng. Soc. Western Pa.*, **16**, 119–121.—A 5-gram sample is dissolved in an evolution flask in a mixture of 30 cc. strong hydrochloric acid and 30 cc. water. The gases evolved are passed through a cadmium chloride solution in which the sulphur is afterwards determined by titration with permanganate. The solution in the flask is evaporated to dryness, and the residue is dehydrated and treated with about 100 cc. water. The insoluble residue is filtered off, ignited, and weighed as tungstic oxide and

Digitized by Google

silica. The contents of the crucible are then treated with hydrofluoric acid and the silica determined by loss. The filtrate is evaporated with nitric acid to expel the hydrochloric acid, then potassium chlorate is added and the precipitated manganese dioxide is filtered off on asbestos. Then it is dissolved in hydrochloric acid with the addition of a little potassium nitrite. After removal by the basic acetate method, of any iron this solution may contain, the manganese is precipitated by bromine water and weighed as Mn_3O_4. In the filtrate from the manganese, the chromium is determined by titration with ferrous sulphate and permanganate. For the determination of phosphorus another 5-gram sample is dissolved in hydrochloric acid, and, after the removal of the tungsten and silicon as before, the phosphorus is precipitated as ammonium phosphomolybdate. The author recommends the direct weighing of the "yellow precipitate." For the carbon determination a sample of 1.5 grams is dissolved in the double chloride of copper and potassium. After a half-hour hydrochloric acid is added, and when all the copper has gone into solution, the residue is filtered off and burnt in a current of oxygen, using a platinum tube. The carbon dioxide evolved is absorbed in a solution of barium hydroxide, and the amount of carbon is calculated from the weight of barium carbonate produced.

Some Rapid Work on Silicons. By DALTON PARMLEY. *Iron Trade Rev.*, **34**, No. 9.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

The Production of Alloys of Tungsten and of Molybdenum in the Electric Furnace. By CHARLES L. SARGENT. *J. Am. Chem. Soc.*, **22**, 783–791.—Alloys of tungsten and molybdenum with nickel, cobalt, and chromium were made by heating the dioxides of these metals in an electric furnace with carbon. The amount of carbon used exerted a greater influence in the purity of the metal than did variations in the strength of the current and the duration of its action. The product invariably contained traces of carbon and unreduced oxide. Tungsten did not form alloys with bismuth and manganese, while molybdenum alloyed with both of these metals, but would not alloy with copper, which combined readily with tungsten. Neither metal would alloy with tin.

Irregular Distribution of Sulphur in Pig-Iron. By RANDOLPH BOLLING. *J. Am. Chem. Soc.*, **22**, 798–799.—The sulphur was determined in drillings made at intervals of $1\frac{5}{8}$ inches in a cast bar 12x14 inches, and was found to vary from 0.023 per cent. at the bottom to 0.036 per cent. at the top.

Digitized by Google

Alloys Made in the Electric Furnace. By Lewis P. Hamilton and Edgar F. Smith. *J. Am. Chem. Soc.*, **23**, 151–155.—Metallic masses, composed of mixtures of various elements, contaminated with iron, carbon, silicon, and "gangue" were obtained by heating the oxides with carbon and iron or copper in a special form of electric furnace. The properties of these metallic masses were not studied.

On the Behavior of Iodine and Bromine Towards Chlorine Heptoxide and Perchloric Acid. By Arthur Michael and Wallace T. Conn. *Am. Chem. J.*, **25**, 89–96.—The authors find no evidence for the statement of Kaemmerer that chlorine may be replaced in its oxygen acids by iodine or bromine. In the preparation of chlorine heptoxide they find that the danger of explosion may be decidedly reduced by keeping the retort containing the phosphorus pentoxide at a lower temperature than —10° (see *this Rev.*, **6**, 114), during the addition of perchloric acid, and for some hours afterward. Instead of heating the retort gradually to 85° in a water-bath, it is better to heat slowly, and after two hours to remove the heptoxide from the receiver, when about two-thirds of the amount formed has passed over; then to heat four hours longer at the same temperature, and finally at 85° to drive off the last traces of heptoxide. A very energetic reaction takes place when iodine and chlorine heptoxide are brought together. The product of the reaction is a white powder which fumes in the air. Heated to 100° in a vacuum, perchloric acid distils off and iodine pentoxide is left behind. The action of anhydrous perchloric acid on iodine is less energetic than that of chlorine heptoxide. The product of the reaction is a moist, pinkish, crystalline powder, which leaves a yellowish, crystalline substance when heated in a vacuum. This substance is extremely hygroscopic, and rapidly turns black on exposure to air, owing to the liberation of iodine. In contact with water it is immediately decomposed with liberation of iodine and formation of iodic acid. An analysis of the substance corresponded to the formula HI_7O_3.

On the Nature of Lead Amalgams. By Henry Fay and Edward North, 2nd. *Am. Chem. J.*, **25**, 216–231.—The authors have determined, by means of a Le Chatelier pyrometer, the freezing-points of a series of lead amalgams containing from 2 to 95 per cent. of lead. The results of the experiments seem to show that in the amalgam of lead and mercury there exists the compound Pb_2Hg, which is soluble in and isomorphous with lead; it therefore lowers the freezing-point of lead as it is successively added to it. This compound is insoluble in mercury, and hence does not lower the freezing-point of mercury; it may readily be separated from mercury by pressure, or very conveniently by means of the centrifugal machine. The freezing-point curve and

Digitized by Google

the microstructure of the solid amalgams failed to show any evidence of a eutectic alloy.

The Basic Nitrates of Bismuth. By F. B. Allan. *Am. Chem. J.*, 25, 307–315.—Normal bismuth nitrate, the basic nitrate, $BiONO_3$, and the basic salt $6Bi_2O_3.5N_2O_5$ were rotated at definite temperatures with varying amounts of nitric acid and water, the rotation being continued until the solid salt was in equilibrium with the solution. The composition of the solid was determined indirectly by estimating the acidity of the solution and the amount of bismuth in it. The salt $BiONO_3 + H_2O$ is the only one formed when bismuth nitrate is poured into water, provided the precipitate is quickly filtered. At 21°, the salt $Bi_{12}O_{18}(NO_3)_{10} + 9H_2O$ is in equilibrium with nitric acid solutions from 0.03 to 0.32 normal, and the salt $BiONO_3$ with solutions from 0.425 to 0.72 normal. At 50°, the salt $Bi_4O_5(NO_3)_2 + H_2O$ is in equilibrium with nitric acid solutions from 0.057 to 0.285 normal, and at 75° with solutions from 0.109 to 0.314 normal. At 50°, the salt $Bi_{12}O_{18}(NO_3)_{10} + 9H_2O$ is in equilibrium with nitric acid solutions from 0.285 to 0.466 normal, and at this temperature no other salt exists containing less N_2O_5.

The Effect of Annealing upon the Physical Properties and the Microstructure of a Low Carbon Steel. By Henry Fay and Stephen Badlam. *Tech. Quart.*, 13, 295–313.—Bars having the dimensions $18 \times 2\frac{1}{4} \times 1\frac{3}{4}$ inches, and containing 0.07 carbon, 0.058 sulphur, 0.10 phosphorus, and 0.32 manganese, were heated to different temperatures in a furnace made of a long porous cup wrapped with a platinum wire and enclosed in an insulating jacket of about 15 inches external diameter and 30 inches in length. The current used to heat the furnace was obtained from the three wire mains of an incandescent lighting circuit. For temperatures below 800°, 110 volts were used; and for temperatures from 800° to 1300°, 220 volts were used. The temperatures were measured by a LeChatelier thermoelectric pyrometer. The tensile strength, the elastic limit, and the elongation were determined for each bar, and a microscopical examination of the structure was made on a specimen cut from each bar. The specimens seemed to show two points of maximum tenacity and elastic limit, one at 890° and another at 1125°. Below 850° the properties of the steel do not change to an appreciable extent, and between 890° and 1125° the steel shows a minimum value at 1000°. Annealing from temperatures above 1125° causes a decrease in strength with increasing temperature. The size of the grain is apparently constant at temperatures below 850°. At 890° the grain is very fine, and from temperatures above this there is a gradual increase in size up to 1125°, and a rapid increase above this point. Above 1100° the structure consists of parallel bands and striations sometimes crossing the grain junctions.

Digitized by Google

Characteristics of the Chemical and Physical Properties of Cast-Iron. By Thos. D. West. *Sibley J. Eng.*, 15, 125–136.—A lecture delivered before Sibley College.

BIOLOGICAL CHEMISTRY.

A. G. Woodman, Reviewer.

On the Alkaloids of Ceanothus Americanus. By H. M. Gordin. *Pharm. Rev.*, 18, 266–268.—In this preliminary note the author discusses the properties of the alkaloid, *ceanothine*, found by Gerlach (*Am. J. Pharm.*, 5, 332) in the root of Ceanothus Americanus. The variations in the melting-point of the "ceanothine" and its behavior with absolute ether indicate that it is not an individual compound. The attempt is to be made to either purify or separate it by means of absolute ether and the formation of derivatives.

Saw Palmetto Oil. By Oswald Schreiner. *Pharm. Rev.*, 18, 217–222.—Shermann and Briggs (*this Rev.*, 5, 109) found in saw palmetto a small amount of a volatile oil and a considerably larger quantity of fixed oil. The question having arisen as to whether the volatile oil is present in the berries or is formed from the fixed oil, the author has examined samples of oil from various sources. The results show that the volatile oil is not present in the dried berries but are not conclusive as yet concerning its exact source.

On the Chemical Composition of Monarda Oils. By W. E. Hendricks. *Pharm. Archives*, 2, 73–78.—The chemical composition of the oil of *Monarda Punctata L.*, as derived from experiments with authentic material, is as follows: About 60 per cent. of the oil is a phenol, largely thymol; of the non-phenol portion of the oil about 10 per cent. is an alcohol, the larger portion consisting of cymene and limonene. The oil of the related *Monarda fistulosa L.* was found to contain carvacrol and cymene but practically no thymol.

The Oil and Terpenes of Aralia Nudicaulis. By William C. Alpers. *Am. J. Pharm.*, 71, 370–378.—By extraction of the dried root with petroleum benzene 1.726 per cent. of fixed oil, of a dark red color and consisting mainly of tri-olein, was obtained. Distillation with steam yielded about 0.04–0.12 per cent. of a yellow volatile oil having a pleasant aromatic odor. This oil consisted principally of a sesquiterpene, $C_{15}H_{24}$. In its reactions and properties this terpene seems to differ from the isomeric compounds identified and the name *Araliene* is proposed for it.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 5.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

The Bio-Chemical Basis of Pathology. BY HENRY A. BUNKER. *Phila. Med. J.*, **7**, 441–446.—A discussion of the chemical transformations which take place in the processes of assimilation and disintegration within the living body. The article is not suited to brief review.

The Chemistry of Ipecacuanha. BY B. H. PAUL AND A. J. COWNLEY. *Am. J. Pharm.*, **73**, 57–66; 107–116.—After reviewing at some length the observations of previous experimenters, the authors present the results of their investigations, which go to show that ipecacuanha resembles cinchona bark, that it contains at least three alkaloids and probably others in small proportion. Of the three alkaloids which have been isolated one is uncrystallizable, but capable of forming crystallizable though extremely soluble salts. For this base the name emetine is reserved. The second alkaloid, named cephaeline, is crystallizable, less soluble in ether than is emetine, freely soluble in alcohol or chloroform; much more soluble than emetine in hot petroleum spirit and readily soluble in solutions of caustic alkali. The third alkaloid, named psychotrine, has been isolated in only small amount and exists in the drug in small proportion compared with the other two.

Physiological and Toxicological Effects of Tellurium Compounds, with a Special Study of Their Influence on Nutrition. BY L. D. MEAD AND WILLIAM J. GIES. *Am. J. Physiol.*, **5**, 104–149.—Experiments carried out on dogs brought to a state of nitrogenous equilibrium showed that non-toxic doses of tellurium (oxide, tellurate, tartrate, and tellurite) did not materially affect metabolism. Large doses retarded gastric digestion, and caused violent vomiting, loss of appetite, and somnolence. Intro-

Digitized by Google

duced under the skin tellurium (tartrate) produced a marked effect, ending in paralysis and death from asphyxia. Tellurium was recovered in considerable quantity from most of the internal organs. Tellurium was eliminated in metallic form, as methyl telluride, and in a soluble form in small quantity, in the urine and bile. Methyl telluride invariably appeared in the breath a few minutes after the introduction of even very small quantities of tellurium and persisted for months after the last dosage. The secretion of acid in the gastric juice was markedly arrested by tellurium compounds, even in small amount. With men, the inhalation of tellurium oxide caused nausea, somnolence, depression, and constipation. Methyl telluride, when inhaled, induced sleepiness and nausea, and imparted its characteristic odor to the breath and the excretions from the skin. The action of tellurium in the body was found to resemble, in many respects, that of selenium, arsenic, and antimony.

Concerning Lipase, the Fat-Splitting Enzyme and the Reversibility of Its Action. By J. H. KASTLE AND A. S. LOEVENHART. *Am. Chem. J.*, **24**, 491–525.—Ethyl butyrate is so easily hydrolyzed by lipase that it has been found possible by means of this reagent to show the presence of lipase in a number of organs and tissues in the animal organism, notably in the liver, stomach and small intestine. Lipase is more stable than has hitherto been supposed but is almost completely removed from its solutions by repeated filtration at ordinary pressure; ethereal salts are hydrolyzed by it most rapidly at 40° C. and at 65° to 70° C. the enzyme is destroyed. The stability of certain ethereal salts toward lipase decreases with increase in molecular weight of the combined acid, the converse of this being found true for the hydrolysis of these ethereal salts by acids. Most of the common antiseptics exert a harmful effect on lipase, this being especially true of sodium fluoride, hydrofluoric acid and the acids generally. A study of the reaction with ethereal salts shows that the velocity of the reaction is not proportional to the active mass of the ethereal salt but is nearly proportional to the concentration of the enzyme. The reaction is incomplete, but approaches completion with very concentrated extracts of lipase or very small amounts of the ethereal salt. The coefficient of velocity as calculated for a reaction of the first order is not a constant but falls off as the reaction proceeds. By means of lipase a synthesis of ethyl butyrate from butyric acid and alcohol has been effected, showing that the reaction is a reversible one.

On the Toxicity of Normal Urine—By MELVIN DRESBACH. *J. Expt. Medicine*, **5**, 315–318.—From normal urine was obtained a substance or substances of an organic nature, possessing marked toxic properties. It is believed that the effects produced could not have been due to any of the organic bodies usually included

Digitized by Google

in the list of compounds contained in normal urine, but the substance has not as yet been isolated.

On the Constituents of Jamaica Dogwood. By Paul C. Freer and A. M. Clover. *Pharm. Arch.*, **4**, 21–28; *Am. Chem. J.*, **25**, 390–413.—The authors have isolated from the bark of the Jamaica dogwood a number of interesting bodies, chief among which are *piscidic acid*, $C_{11}H_{12}O_7$, its ethyl ester and other derivatives. The presence of a number of other substances has been demonstrated, but lack of material prevented the determination of their exact chemical constitution. Evidence is presented to show that the substance called piscidine and hitherto supposed to be the active principle of Jamaica dogwood is a mixture and is pharmacologically inert.

CARBOHYDRATES.

A. G. Woodman, Reviewer.

Notes on Sugar Beets. By P. F. Trowbridge. *J. Am. Chem. Soc.*, **23**, 216–223.—As the average of twenty-five determinations, the author finds 0.919 to be the factor representing the relation of the sugar in the juice to the sugar in the beet. The average sugar content of a number of beets grown under precisely similar conditions was 12.61 per cent., the maximum being 18.2 per cent., and the minimum 8.7 per cent. Comparison of analyses by digestion with hot water and digestion with hot alcohol showed practically no difference. The highest sugar content was found to be in the middle portion of the beet, the lowest in the upper portion.

G. W. Rolfe, Reviewer.

On the Results of a Search for Other Sugars Than Xylose and Dextrose in the Products of the Hydrolysis of Wood from the Trunks of Trees. By F. H. Storer. *Bull. Bussey Inst. Harv. Coll.*, **2**, 437–467.—The current view that the wood of tree trunks contain much starch is an error which arose formerly from use of improper methods of estimating starch; *viz.*, hydrolysis by dilute acids. It is now known that when wood is hydrolyzed by acids much of the xylan contained is changed to xylose, till recently considered dextrose derived from starch. Testing trunk wood with barley malt shows little starch actually, although at certain seasons appreciable quantities are found in the twigs and roots. To solve the question of the origin of the great mass of sugar obtained in the spring from the trunks of maples and other trees, the author has studied the action of hydrolysis of acids on maple and birch wood, also cotton. The amounts of sugars formed were estimated with Fehling's liquor and the rotatory power of these sugars was noted. The method of investigation was novel in that an

Digitized by Google

approximation to the true specific rotation was got in each instance by determining with Fehlings's liquor how much sugar was contained in 100 cc. of the impure product of the hydrolysis and calculating from this factor and the observed angle of rotation an approximation of the specific rotation, called by the author "*quasi* $(a)_D$." The values thus obtained fall somewhat higher than the true specific rotatory powers. As the result of many trials, no other sugars than xylose and dextrose were detected; but it was observed when the woods or the cotton were first treated with strong sulphuric acid, that considerable quantities of the wood dextrin of Bechamp (subsequently studied by Honig and Schubert and others) was formed, and that this dextrin is not readily changed to sugar by hydrolysis. Serious doubts are thus cast on the conclusions of those chemists (notably Fleschig and Winterstein) who have claimed that cellulose may be readily and completely changed into dextrose by treating with strong sulphuric acid and subsequent hydrolysis after diluting with water.

ASSAYING.

H. O. HOFMAN, REVIEWER.

The Calkins Umpire Ore Sampler. BY THE EDITOR. *Eng. Min. J.*, **71**, 534.—This continuous sampling machine consists of two buckets, one above the other, revolving in opposite directions. Each bucket has a central cone from which four radial partitions extend to the sides, thus giving four sectorial divisions, of which two are closed and two open at the bottom. Of 16 pounds of ore fed into the machine, 8 pounds remain in the upper bucket, 4 pounds go into the lower bucket and 4 pounds pass as sample into the receiver below. The machine is 3 feet, 7 inches high and weighs 55 pounds; it is easily cleaned. The claims made for it are too great, since its use must be limited, as is the case with all continuous sampling machines.

The Use of Iron in Assaying. BY R. W. LODGE. *Eng. Min. J.*, **71**, 329–330.—The author corrects the statement made editorially in a previous issue of the same journal (**70**, 734) that iron sulphide, formed in assaying sulphurous ores, is oxidized and fluxed. He shows that the amount of matte which will separate out is governed by the amount of alkali added to the charge; in fact, that with a sufficient amount of alkali, the whole of the matte will be held in solution or suspension. In the assay, all the sulphur, however, does not combine with the iron and the alkali; part of it is oxidized and passes off into the air.

Braun's "Coronet Rolls." BY THE EDITOR. *Eng. Min. J.*, **71**, 435–436.—These rolls, 2½ inches in diameter and 1¼ inches wide, are made of hardened steel and run in phosphor-bronze

Digitized by Google

boxes; both rolls are operated by one crank; a feed plate at the front facilitates the insertion of a small button and a second plate at the back, closely wiping the bottom roll, prevents the cornet from dropping on the floor. The net weight of the machine is 57 pounds and the weight, when boxed for shipping, is 85 pounds.

TECHNICAL CHEMISTRY.

F. H. THORP, REVIEWER.

The Chemistry of Insecticides. By F. T. SHUTT. *Canada Exp. Farms Rept.*, **1899**, 148–149.—An analysis of a sample of Paris green indicated 44.2 per cent. of arsenious acid, of which 4.56 per cent. was soluble in water. An emulsion of kerosene and crude carbolic acid with some soap, was found effective in destroying borers and bark lice. The addition of copper sulphate to the emulsion caused separation of the emulsion constituents and is not to be recommended. Addition of a strong tobacco decoction to Bordeaux mixture caused separation of the constituents, but only after standing some time. If used fresh, this would not injure the Bordeaux mixture.

Comparative Hide-Powder Tests. By W. H. KRUG. *Leather Mfr.*, **12**, 10–11.—The hide-powder made by the Vienna Experiment Station having given unsatisfactory results recently, and being found acid in its character, the author and two others, undertook test analyses on quebracho extract, using the same sample, and employing hide-powder of the above-named make. Trials were made with the powder as furnished (*i. e.*, acid), and also after neutralization with sodium carbonate. The tabulated results show close concordance with the unneutralized powder; but after neutralization the absorption power of the powder decreases; the filtrate is turbid and contains tannin. After neutralization, twice as much powder is required in order that the filtrate may be free from tannin. A method of neutralizing and washing the powder is also described.

Comparison of the International Filter-Tube Method and the Official Hide-Powder Method. By H. W. WILEY AND W. H. KRUG. *Leather Mfr.*, **12**, 9–10.—Test analyses on identical samples of oakwood extract, chestnut extract, mimosa extract, solid quebracho extract, valonia, and mimosa bark, were carried out by the filter-tube method in Prof. Procter's laboratory, and by the official method in the laboratory of the U. S. Dept. of Agriculture. The results of both series of tests are tabulated and show that the filter method gives lower non-tannins than the official method, and correspondingly higher tannins.

Concerning Retene, Petrolene, and Asphaltene. By S. F.

Digitized by Google

PECKHAM. *J. Franklin Inst.*, **151**, 50–61.—The paper is a protest against the use of the terms retene or retine, and petrolene, and asphaltene in reporting analyses of solid bitumens and bituminous minerals. The author prefers to report the percentage soluble in petroleum ether as "the petroleum ether soluble," and not as "petrolene," etc. A paper by Edward J. De Smedt (*Paving*, 1893) is discussed and several erroneous statements are shown; particularly in regard to the sulphur content of "retine," petrolene, and asphaltene. Retene is described in chemical literature as a body crystallizable from alcohol; the author could obtain no crystallized solid from the alcohol extract of California and other asphaltums. The term "retine" he fails to find. The article by De Smedt contains references to researches by Le Bel and Muntz as authority concerning retene, but the author fails to find such memoirs. In recent years, the terms petrolene and asphaltene have been loosely applied to the residues, soluble and insoluble, obtained with ethyl ether, petroleum ether, acetone, and other menstrua; the author asserts that the material dissolved from one asphaltum by these solvents, may be quite different from that extracted from another sample. An asphaltum having but a trace of chloroform soluble and only a small amount of turpentine soluble, may not be distinguished by the eye from one that dissolves to the extent of one-third or one-half in chloroform. It is stated that weathered asphalts yield a large percentage of chloroform soluble. A citation to an article by O. Hesse (*Arch. d. Pharm.*), frequently quoted in the literature, is shown to be erroneous, the article being by Otto Helm (*Arch. d. Pharm.*, III, **13**, 396). Analyses of grahamite by Miss Laura A. Linton shows it to contain about 50 per cent., each petrolene and asphaltene; according to De Smedt it should contain 11.045 per cent. of sulphur; analysis showed 0.6125 per cent. sulphur present. Other discrepancies in the sulphur content of albertite and several bitumens, as calculated according to De Smedt, and as found on analysis, are pointed out. It being admitted that the portions of different bitumens dissolved by petroleum ether may not be identical chemically, or even resemble each other, varying in their physical properties, the question is asked: Of what value is an analysis of asphalt by solution? The answer is that the value lies *only* in analyses made with the same solvents and under the same conditions, and especially as applied to different specimens from the same locality, as a means of comparison. It is useless to compare the results obtained from a Pacific coast asphaltum, using petroleum ether made from California petroleum, with those obtained from Trinidad or Bermudez asphaltum dissolved in ethyl ether, or petroleum ether from Eastern petroleum. A uniform method by the same solvents should be adopted by all who are engaged in analyzing asphaltum.

Digitized by Google

Aluminium at the Paris Exposition (1900). By JOSEPH W. RICHARDS. *J. Franklin Inst.*, **151**, 107–114.—The progress of the aluminium industry as shown at the five international exhibitions held in Paris, in 1855, 1867, 1878, 1889, and 1900, is interestingly described. Up to 1900 the material was all obtained by the Deville process, using metallic sodium; but in 1889 a great reduction in price with consequent large increase in the use of the metal was noticed, chiefly due to the cheap production of metallic sodium by the processes of Castner and Netto. At this time the Cowles' alloy products were first shown. In 1900 *all* of the metal exhibited was made by electrolytic processes; the production amounted to 7,000 tons and the price was 30 cents per pound. A list of the firms producing aluminium and a description of their exhibits in detail then follows.

A Discussion of Recent Developments in the Fire-Proofing of Wood. By JOSEPH L. FERRELL. *J. Franklin Inst.*, **151**, 161–177.—The first seven pages of the article are filled with a rambling commentary upon the "old methods of fire-proofing" and the faults of the machinery used; the time consumed and cost of the chemicals are claimed to make the processes prohibitive. Then the author gives a very general account of the "new process." Instead of low pressures and long time, high pressures for short times were tried; steaming and vacuum are discarded. (*Compare this Rev.*, 7, 64.) Pressures from 50 to 1,200 pounds were tried and "the results noted." To the reviewer at least, the article would have had greater interest if some of these results were stated. It was, however, discovered "that each thickness of each wood had its exponent of resistance to compression, but the greater pressures were apt to overcompress and distort the wood." This is obviated by the use of a hydraulic accumulator by which uniform pressure and more rapid saturation are obtained. Some details and a drawing of portions of the apparatus are given. Concerning the chemicals available for fire-proofing previous to this investigation, phosphate of ammonium is ranked first in efficiency and ammonium sulphate next. Both of these are too expensive, render the wood brittle, more hygroscopic and corrode metals with which they come in contact. But now, after years of experiment, two formulae have been discovered, which will reduce the cost of chemicals to less than one-third of what it has been, and the saturated wood is free from the defects of the old process. It retains its color, does not corrode metals, is not hydroscopic nor brittle, will take paint and varnish and the chemical does not volatilize. The time of treatment is very short and penetration is complete. No hint as to the nature of these chemicals is given "as the patents are not sufficiently advanced." Large timbers, as well as boards, can be treated. Some illustrations of a burning test applied to two

Digitized by Google

small buildings, exactly alike, but one made of fire-proofed wood, are given, but the description is very meager.

A Brief Sketch of the Essential Requisites of "Powder" as Distinguished From "Explosives." By W. J. WILLIAMS. *J. Franklin Inst.*, **151**, 194–207.—The author defines a "powder" as a means of propulsion for projectiles. An "explosive" is a means of producing powerful shattering effects. In a powder, the chemical changes are comparatively slow or progressive, so that the whole of the power is not released in the shortest possible period, but gradually; an explosive develops its total energy in the shortest possible period of time. A powder burns; an explosive detonates; a powder pushes while an explosive strikes a shattering blow. The requisites of a powder are then summed up under the following heads: (1) The velocity developed; (2) the pressure attained; (3) specific gravity and gravimetric density; (4) granulation; (5) temperature attained during combustion; (6) susceptibility to ignition; (7) smoke and ash; (8) friability; (9) sensitiveness to shock; (10) suitability for loading by machinery; (11) sensitiveness to environment, such as heat, moisture, etc.; (12) stability. Each of these headings is then taken up in detail and considered at length, but no condensed abstract can be made.

High Explosives: Their Uses in Peace and War. By E. L. ZALINSKI. *International Monthly*, **1**, 676–692.—In this popular discussion is given a résumé of some of the more common high explosives, their composition, properties and the conditions under which they may be used. Nitroglycerine; guncotton; dynamites and their various combinations as blasting gelatine, explosive gelatine, and gelatine dynamites are briefly considered, and also the Sprengel group. The picric acid class is given some attention because of its public notoriety rather than intrinsic merit. It is pointed out that the presence of small amounts of metallic oxides in these explosives constitute an element of unusual danger. This class requires very powerful detonators to evolve their full power and when not fully exploded they evolve dense clouds of noxious fumes. The use of lyddite in war has demonstrated that incomplete explosions are frequent but in even a greater number of cases entire failure to explode occurs. The same result is likely to follow the use of melinite. Liquid air as an explosive is powerful but the chances of its being used industrially or for war, are small. All high explosives are capable of several orders of detonation, from mere ignition to the most powerful explosion; these differences may be caused by the nature of the "tamping" or by the character and manner of initial ignition and explosion. With all high explosives, mercury fulminate is best adapted to educing the

Digitized by Google

maximum power of the explosive; and it is also important that the proper quantity of fulminate be used. The more insensitive the explosive the greater the charge of fulminate required. The position of the exploder cap in the charge is also very important. A table of the relative force of various high explosives is given, based on gunpowder as unity; in this, nitroglycerine stands at 12; blasting gelatine, 16; dynamite No. 1, at 10; and lyddite and melinite, 3 each. The influence of the specific gravity in obtaining results from explosives is discussed briefly, and it is then shown that the time element in the explosion governs the energy realized. The actual energy secured seems to be more or less independent of the chemical constitution. The methods of using high explosives are then considered somewhat at length.

Rubber in Guatemala. By Jas. C. McNally. *U. S. Consular Rep.*, **65**, 371–375.—This is a general description of the cultivation and collection of crude rubber in that country. Planting and cultivation of the *Castilloa elastica* is now well established; the tree develops in from seven to nine years, and then may be tapped twice a year. The yield is from two to four pounds of milk yearly, and the resulting rubber is worth from one to two dollars. The method and precautions to be observed in tapping are stated, and also the process of coagulating the juice.

The Condition, Prospects, and Future Educational Demands of the Chemical Industries. By Wm. McMurtrie. *J. Am. Chem. Soc.*, **23**, 71–89.—This article is the presidential address delivered at the Chicago meeting of the Society, December 27, 1900. It contains an excellent review of the progress of the chemical industries in this country, especially during the last two decades. Tables showing the values of chemicals imported and exported during this period are given, from which it is seen that in certain lines an enormous growth in our domestic industries has taken place; but in other directions there is still necessity for further developments of our own sources of crude materials. The question of the proper education of technical chemists is also ably discussed.

A Comparative Method of Determining the Fusing-Points of Asphalts. By Chas. F. Mabery and Otto J. Sieplein. *J. Am. Chem. Soc.*, **23**, 16–20.—The method consists in heating the specimen in a narrow beaker which is supported in a glycerine-, water-, or air-bath. The dimensions of a convenient apparatus are given and by maintaining certain constants the results are reasonably close. The page number given for this article in the index on the cover is incorrect.

Manufacture of Rubber in the Philippines. By G. D. Rice. *Western Electrician*, **27**, 332.—A description of the methods of preparing crude rubber.

Digitized by Google

The Manufacture of Uranium Compounds. By J. Ohly. *Min. and Sci. Press*, **82**, 125–134.—A complete analysis of carnotite (potassium-sodium vanadio uranate) by Hillebrand is quoted, and determinations of U_3O_8 in six samples by the author are the only special features to note in the article. The author finds that Hillebrand's analysis was of a selected ore sample, and that the average value in uranium oxide is seldom above 6 per cent., although two of the author's analyses show 8.68 and 17.06 per cent. U_3O_8, respectively. The uranium is extracted by treating the ore with dilute nitric acid, and precipitating the uranium with caustic soda when a sodium uranate, $Na_2U_2.6H_2O$, contaminated with iron, alumina and lime, separates as crude "uranium yellow." From this the refined uranium oxide, or sodium uranate is obtained. The methods of extracting uranium from pitchblende are also explained. Uranium compounds are employed for making a fluorescent, greenish-yellow glass, for orange and black glazes on porcelain and in china painting. The carbide of uranium is employed as a substitute for platinum in pyrometers owing to its high melting-point, and as an addition to steel for improving its toughness and tensile strength.

The Cause of Foaming in Locomotive Boilers. By C. Herschel Koyl. *Railroad Gazette*, **32**, 663, 664.—The author believes that foaming is caused by fine particles of suspended matter in the boiler water, or at least that it will not foam unless such suspended matter is present. He discredits the idea that free alkali or alkaline salts alone will cause foaming. Experiments are described in which he introduced pure sodium carbonate into boiling distilled water without causing foaming; but the addition of a fine insoluble powder, such as calcium carbonate or magnesia alba, caused foaming. He shows that the introduction of rain or other soft water into a boiler previously fed with hard water, causes foaming owing to the disintegrating action of the pure water on the scale left by the hard water. The addition of alkali to the feed water produces the same effect, if the boiler has been previously scaled, because of its disintegrating action on the scale. Three physical conditions are recognized in boiling liquids: "bumping," when the steam rises in great bubbles, which throw the liquid about, the thumping being produced by the liquid falling back to its place; "quiet boiling" when the steam enters the water freely and rises through it without difficulty; "foaming," when steam and water are so intimately mixed that they cannot be easily separated and the liquid is carried out with the bubbles of steam. The author explains the phenomena of supercooling and superheating and then reasons that pure water in a clean boiler tends to become superheated at the heating surface and therefore "bumps," but the presence of small quantities of foreign matter, such as all ordinary water contains, furnishes

Digitized by Google

small surfaces from which the steam is more frequently liberated, generally resulting in quiet boiling; but if the number of particles be increased, the liberation of steam throughout the water in the vicinity of each particle, causes such numerous bubbles, which so fill the mass of liquid, that it occupies the whole space of the boiler, making it impossible for the bubble to break at the surface, without throwing off water mechanically with the steam. The ordinary cases of foaming produced by the addition of a precipitant, or of alkaline feed water, or of muddy water, or of artificially softened water, are then considered in some detail.

The Treatment of Water for Boilers. By H. STILLMAN. *Railroad Gazette*, **32**, 675.—This is a general discussion of the methods of purifying water for locomotives.

Fertilizers.—*Canada Exp. Farms Rpt.*, **1899**, *137–143; Conn. Sta. Rpt.*, **1899**, (*I*), *92; Ind. Purdue Univ. Spec. Bull., Aug.*, **1900**; *La. Sta. Bull., No.* **58**, *189–264; Mass. Hatch Sta. Bull., No.* **68**; *Me. Sta. Bull., No.* **66**; *No.* **72**; *Miss. Sta. Bull., No.* **64**; *N. C. State Bd. Agr. Bull., No.* **21**; *N. J. Sta. Bull., No.* **145**; *N. Y. Sta. (Geneva) Bull., No.* **177**; *Penna. Dept. Agr. Bull., No.* **54**; *Penna. Dept. Agr. Rpt.*, **1898**, *821–974; R. I. Sta. Bull. Nos.* **67**, **70**; *S. C. Sta. Rpt.*, **1899**, *9–16; 32–34; S. C. Sta. Bull., No.* **54**; *W. Va. Sta. Bull., No.* **65**; *Wis. Sta. Bull., No.* **86**; *Vt. Sta. Bull., Nos.* **79**, **80**; *Ky. Sta. Rpt.*, **1898**, *16*.

Digitized by Google

Digitized by Google

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 7.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

PHYSICAL CHEMISTRY.

H. M. GOODWIN, REVIEWER.

Differences of Potential between Metals and Non-Aqueous Solutions of Their Salts. II. BY LOUIS KAHLENBERG. *J. Phys. Chem.*, 4, 709–714.—This is a continuation of previous work (*this Rev.*, 6, 11), throwing doubt on the applicability of Nernst's theory to cells composed of non-aqueous solutions. Silver nitrate in pyridine and in acetonitrile and cadmium iodide in acetonitrile were the solutions used. As only five concentration cells were measured and no account taken of the P.D. at the liquid-liquid junction in the computation, further experiments are certainly desirable before discarding Nernst's theory, or questioning its applicability "even in the case of aqueous solutions."

Gas-Polarization in Lead Accumulators. BY C. J. REED. *J. Phys. Chem.*, 5, 1–17.—The author attempts to disprove the results and conclusions published by Nernst and Dolezalek (*Ztschr. für Elec. Chem.*, 1900). For details of the calculations and experiments reference must be made to the article.

Laboratory Apparatus for Decomposition Voltages. BY WILDER D. BANCROFT. *J. Phys. Chem.*, 5, 133–136.—A milliammeter is placed in series with the electrolytic cell around the terminals of which a high resistance voltmeter is connected. The impressed electromotive force is gradually increased, while the readings of the ammeter and voltmeter are simultaneously noted. The voltage corresponding to the sudden increase of current through the cell is taken as the decomposition voltage. Although no great accuracy is claimed for the method, it is a simple and instructive laboratory experiment.

On the Dielectric Constants of Nitriles. BY HERMAN SCHLUNDT. *J. Phys. Chem.*, 5, 157–170.—The following values

Digitized by Google

were obtained by Drude's well known method of electrical oscillations.

Solvent.	*t*	D.C. (Air = 1.)
Hydrocyanic acid	21	95
Acetonitrile	21	36.4
Propionitrile	22	26.5
Butyronitrile	21	20.3
Isopropyl cyanide	24	20.4
Valeronitrile (*n*)	21	17.4
Isobutyl cyanide	22	17.95
Capronitrile	22	15.5
Benzonitrile	21	26.0
Benzyl cyanide	21	14.9
Toluonitrile (ortho)	23	18.4
Pyridine	21	12.4
Quinoline	21	8.8

These results taken in conjunction with the available results on the molecular conductivity of silver nitrate in the above solvents show that the Nernst-Thomson rule is verified only in the case of the homologous series,—aceto-, propio-, and butyro-nitriles. The molecular conductivity of silver nitrate in propionitrile, on the other hand is much greater than in benzonitrile, although the D.C. of both solvents is nearly identical. A pyridine solution conducts better than a corresponding butyronitrile solution, although the D.C. of the former solvent is only 61 per cent. of that of the latter.

Conductivity measurements of salts in liquid hydrocyanic acid which are now being made will be of much interest in view of its abnormally high dielectric constant.

The Electromotive Force of Polarization of Electrolytic Cells for Very Small Current Densities. By Barry Mac Nutt. *Phys. Rev.*, **8**, 237–243.—The variation of the e.m.f. of polarization with the time was noted when a current was passed through such reversible cells as zinc electrodes in zinc sulphate, copper electrodes in copper sulphate, etc. It was found that if the cell had been standing on open circuit for a long time that the polarization gradually decreased with the time. If, however, on closed circuit the current was suddenly reduced, the polarization gradually increased with the time. The author attempts to explain these results by assigning a different osmotic pressure to the ions under the different conditions of the experiment. No reference is made to the undoubted concentration differences arising at the electrodes.

On the Application of the Dissociation Theory to the Electrolysis of Aqueous Solutions Containing Two Electrolytes with a Common Ion. By J. G. MacGregor. *Phys. Rev.*, **8**, 129–140.—The author discusses the results of Schräder and Hopfgartner by comparing them with the relative amounts of ions transferred in the electrolysis of invert electrolytes, as calculated

Digitized by Google

by the relation $\alpha_1 N_1 v_1 \mu_\infty / \alpha_2 N_2 v_2 \mu_{\infty_2}$, the values of α (electrolytic dissociation) being obtained by the graphical method described by the author in 1896. The agreement was found to be fairly satisfactory in the case of mixtures of NaCl and HCl, and of KI and KCl, but less so in the case of $BaCl_2$ and HCl. The discordant results with $CuSO_4$ and H_2SO_4 were explained on the assumption of the presence of acid salt in the solution.

The Magnetic Molecular Susceptibility of Salts of the Iron Group. By O. Liebknecht and A. P. Nills. *Phys. Rev.*, **10**, 215–228.—The method employed was that described by du Bois, in which a paramagnetic solution is diluted with a diamagnetic solvent until the motion of the meniscus of the resulting mixture in a capillary tube placed in a strong magnetic field became zero. The halogen salts, nitrates and sulphates of chromium, manganese, iron, cobalt, nickel, and copper were investigated with the following general results: The molecular susceptibility increases from chromium to manganese and iron, and then decreases to copper. With the halogens there is an increase from the fluoride to chloride, with a following decrease to the iodide. Simple additive properties do not appear to be present. Experiments on the effect of a magnetic field on surface tension as indicated by the "dropping" method confirmed Quincke's results and conclusions in the case of paramagnetic solutions. In the case of diamagnetic water, the dropping could be completely stopped by a field in which the magnetic force acts upward against the hydrostatic pressure. Unmagnetic solutions dropping in an atmosphere of illuminating gas were uninfluenced by a magnetic field.

SANITARY CHEMISTRY.

E. H. Richards, Reviewer.

A Study of the Relative Value of Lacmoid, Phenacetolin, and Erythrosine as Indicators in the Determination of the Alkalinity of Water by Hehner's Method. By Joseph W. Ellms. *J. Am. Chem. Soc.*, **21**, 359–369.—The author concludes that all the indicators are suitable with proper care and skill, but that if uniformity of results within very narrow limits is desired the preference should be given to erythrosine.

Measurements of "Turbidity" in Water. By W. P. Mason. *J. Am. Chem Soc.*, **21**, 516–517.—The turbidity of the water is compared with that of a standard kaolin solution (1 gram per liter) in a 2-foot tube and is expressed in parts per million.

Standard Methods of Water Analysis. Preliminary Report, *Comm. Am. Pub. Health Assoc.*, Geo. W. Fuller, Chairman. *Eng. Record*, Oct. 27, 1900; *Science*, **12**, 906–915; *Ann. Rept. Am. Pub. Health Assoc.*, **26**, 315–316.—The limits of an ab-

Digitized by Google

stract will not permit of any extended notice of the twelve different chemical tests discussed in the report.

The Artesian Basins of Wyoming. By Wilbur C. Knight, *Wyo. Expt. Sta. Bull.*, 45, 1–250.—In connection with a discussion of water-bearing zones the author gives analyses of twenty-seven wells and springs from various geological formations in the state. These range from 8 grains per gallon of total solids to 1115 grains; from 0.7 to 40 grains $CaCO_3$; from 0.2 to 73 grains $MgSO_4$; with other ingredients in similar fluctuating proportions. On pages 182 and 183 will be found a summary of the character of the water to be expected from seventeen horizons. As usual the purest water is found in the Archean.

The Determination of Phosphates in Potable Waters. By A. G. Woodman and L. L. Cayvan. *J. Am. Chem. Soc.*, 23, 96–107.—After a résumé of previous work and a description of the methods used, the authors give with diagrams the results of their study of the effect of temperature on the color developed and on dehydration of silica. A colorimetric method is described which is applicable to colorless well waters but has not yet been made suitable to colored surface waters.

Permanent Standards for Use in the Analysis of Water. By Daniel D. Jackson. *Tech. Quart.*, 13, 314–326.—The author says that colorimetry plays such an important part in the analysis of water that standards for comparison are in constant use. Much time would be saved if permanent solutions could be kept on hand and the paper is an account of the preparation of six of these standards, *viz.*, for color, turbidity, nitrogen as ammonia, as nitrite, and as nitrate, and for iron.

Description of Experimental Filter Plant at Pittsburgh, and Results of Experiments. By Morris Knowles. *J. N. E. Water Works Assoc.*, 15, 148–188.—After a discussion of the apparatus and methods used eight tables of results of the chemical examination of the water of the Allegheny river and of the effluents of the sand and mechanical filters are given. The following summary of the general results for the seven months ending August 31, 1898 will be of interest.

	Percentage of constituents removed.			
	Sand filters.		Mechanical filters.	
	No. 1.	No. 2.	Warren.	Jewell.
Color	73	73	88	88
Nitrogen as alb. ammonia	47	48	53	57
Free ammonia	10	10	5	10
Nitrites	..	..	..	..
Nitrates	—13	3	3	8
Chlorine	2	5	6	12
Total solids	30	31	38	39
Suspended matter	100	100	98	98
Total hardness	—34	—35	8	10
Alkalinity	—45	—46	33	31
Sulphuric acid	..	..	—62	—38

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 8.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

ANALYTICAL CHEMISTRY.

PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

A Simple Test to Distinguish Oleomargarine from Butter. BY CHARLES LATHROP PARSONS. *J. Am. Chem. Soc.* 23, 200–202.—A 100 cc. beaker is half filled with sweet milk; this is heated to boiling and from 5 to 10 grams of butter or oleomargarine added. The mixture is stirred with a wooden splinter, about the size of a match, until the fat is melted. The beaker is then placed in cold water and the milk stirred until the fat has hardened. At this point the fat, if oleomargarine, can easily be collected together into one lump by means of the rod, while if butter it will granulate and cannot be so collected.

A Rapid Method for the Detection of "Aniline Orange" in Milk. By HERMANN C. LYTHGOE. *J. Am. Chem. Soc.*, 22, 813, 814.—The presence of "aniline orange" is shown by the pink color given to the curd when hydrochloric acid is added to the milk in testing for formaldehyde by boiling with hydrochloric acid and ferric chloride.

Detection of Foreign Coloring-Matter in Spirits. By C. A. CRAMPTON AND F. D. SIMONS. *J. Am. Chem. Soc.*, 22, 810–813.—The method is based on the insolubility in ether of the coloring-matter of caramel and prune juice. The test is made by shaking the sample with ether, separating the ethereal from the watery layer, and comparing the color of the latter with the color of the original spirits by means of the tintometer. Genuine spirits gives up about 40 to 50 per cent. of its color, while spirits colored by caramel alone are entirely unaffected, the ethereal layer remaining water-white.

Digitized by Google

The Composition of American Wines. By W. D. Bigelow. *U. S. Dept. Agr., Div. of Chem., Bull.* **59**, 1–76.—This bulletin contains tabulated results of analysis of all samples of American wine having a definite history or origin, a discussion of the interpretation to be placed on the analytical results and a description of the methods of analysis employed.

Report on Food Products for 1900. By B. W. Kilgore and W. M. Allen. *Bull. N. C. State Board of Agr.* (*1900*), **12**, 1–61.—Details are given of the examination of about 500 samples under the North Carolina "Pure Food Law" of 1899. Especial prominence is given to the presence of preservatives and artificial coloring-matters.

The Composition of Jellies and Jams. By L. M. Tolman, L. S. Munson, and W. D. Bigelow. *J. Am. Chem. Soc.*, **23**, 347–353.—Analyses are given of over forty samples of fruit and fruit products of known origin. The determinations made include total solids, ash, total acid (as H_2SO_4), proteids ($N \times 6.25$), reducing sugars and cane-sugar. The analytical methods are briefly described.

Cloves. By A. McGill. *Canada Inland Revenue Dept., Bull.* **73**, 1–14.—Twenty-eight samples of whole cloves have been examined as follows: Moisture was determined by drying the ground sample over sulphuric acid *in vacuo* for 24 hours; the total volatile matter was determined by drying the sample at 98° C. for 18 hours; and the total extractive matter (fixed and volatile oils) was found by extraction of the dry substance with petroleum ether. From the results obtained the author is of the opinion that no sample of cloves of good quality should yield less than 14 per cent. of volatile oil when treated in the manner described.

Twenty-fourth Ann. Rept. Conn. Agr. Expt. Sta. (**1900**), **Part II**, 105–218.—This bulletin contains the results of further examination of food products under the Connecticut Pure Food Law. In all, 1339 food samples have been examined during the year. A detailed description is given of the methods employed in the examination of lard, olive oil, and baking-powders, together with the results of analysis of numerous samples. Several samples of spring water were also analyzed.

On Heptane from Coniferous Trees. By W. C. Blasdale. *J. Am. Chem. Soc.*, **23**, 162–164.—Specimens of the exudation from five species of coniferous trees were examined and heptane found in two of them, *Pinus Jeffryi* and *P. Sabiniana*.

The Complete Analysis of Feeding Materials. By C. A. Browne, Jr., and C. P. Beistle. *J. Am. Chem. Soc.*, **23**, 229–

Digitized by Google

236.—The authors have made a detailed analysis of a sample of distillery waste and point out the errors which may result from the action of the solvents employed upon the pentosans. Malt extract and even water alone were found upon prolonged digestion to dissolve a considerable amount of pentosans. Thus the percentage of dextrin and of starch obtained in the usual method of analysis might be appreciably above the truth.

The Determination of Pentosans. By G. S. Fraps. *Am. Chem. J.*, **25**, 501–508.—When vegetable substances are distilled with hydrochloric acid there may be formed besides furfural a substance which precipitates phloroglucinol and is destroyed by redistilling. The author uses the term "furaloid" to designate this substance. Furaloid-yielding bodies, which were found in all the materials tested, are hydrolyzed by boiling 1.25 per cent. sulphuric acid and lost in the subsequent evaporation. Furaloid is not formed by the action of hydrochloric acid on the pentose sugars.

Methods of Determining Proteid Nitrogen in Vegetable Matter. By G. S. Fraps and J. A. Bizzell. *J. Am. Chem. Soc.*, **22**, 709–719.—The authors have made a study of the applicability of phosphotungstic acid and bromine as precipitants for the proteids of vegetable materials and reach the following conclusions: Phosphotungstic acid does not precipitate proteids completely at 90° or 100°, but at 60° precipitates (at least in the case of vegetable materials) very nearly the same amount of nitrogen as copper hydroxide. Bromine is not a suitable precipitant for proteids in vegetable materials and extraction of the proteids with hot water does not always give concordant results. The method open to the fewest objections seems to be the method proposed by Stutzer (*J. f. Landw.*, **28**, 103), which is the one in general use.

Loss of Sulphur in Preparing Ash of Plants. By G. S. Fraps. *J. Am. Chem. Soc.*, **23**, 199, 200.—The amount of sulphur was determined in a variety of plants by two methods: *a*. 10 grams were burned to an ash at the lowest possible temperature, and the sulphur determined in it. *b*. 10 grams substance were burned with the addition of 20 cc. of a solution of calcium acetate (29.2 grams per liter). The sulphur obtained by *a* was from 4 to 100 per cent. less than that found by *b*. It was not determined whether or not all the sulphur was retained by the calcium acetate.

A Method for the Determination of the Availability of Organic Nitrogen in Commercial Fertilizers. By John Phillips Street. *J. Am. Chem. Soc.*, **23**, 330–338.—An amount of material equivalent to 0.075 gram of nitrogen is weighed into a 500 cc. Erlenmeyer flask, 100 cc. of neutral 1.6 per cent. potas-

Digitized by Google

sium permanganate added, and the mixture digested on the steam-bath for twenty minutes with occasional shaking. The solution is filtered and washed with 125 to 150 cc. of water. The nitrogen in the undigested residue is determined by the usual Kjeldahl process. Tests on a considerable variety of fertilizers show that the method places them in about the same rank as that assigned by vegetation tests and agricultural experience.

The Chemical Composition of Maryland Soils. By F. P. VEITCH. *Md. Agr. Expt. Sta. Bull.*, 70, 64–114.

Paraffine as a Substitute for Ether in the Preparation of Extract of Nux Vomica, U. S. P. By FERDINAND A. SIEKER. *Pharm. Rev.*, 19, 56–61.—Paraffine is preferred to ether because it is cheaper, is not dangerously inflammable, and can be easily separated after congealing; it separates practically everything that ether separates, as well as an insoluble brown substance that ether does not separate.

The Accurate Measurement of Tints and Shades of Colors. By OSWALD SCHREINER. *Pharm. Rev.* 19, 61–66.—This is a description of the construction and manner of using the well-known Lovibond tintometer.

The Detection of Methyl Alcohol in Pharmaceutical Preparations. By FERDINAND A. SIEKER. *Pharm. Rev.*, 19, 117–120.—The author employs the well known method of oxidizing a part of the alcohol vapor by a hot oxidized copper spiral. The presence of methyl alcohol is shown by the odor of formic aldehyde.

The Specific Gravity Tables of the U. S. Pharmacopoeia. By A. B. LYONS. *Pharm. Rev.*, 19, 101–107.—The author criticizes the lack of unity of plan of the tables as arranged at present and submits two tables, one of the strength of hydrochloric acid of different densities and the other a specific gravity table for glycerine, as models for future tables of this kind.

The Assay of Coca. By WILLIAM R. LAMAR. *Am. J. Pharm.*, 73, 125–131.—The author expresses the opinion that the discordant results in the assays previously published are due to the extreme instability of the alkaloids accompanying coca. For this reason any excess of strong alkali must be avoided and the strength of acid employed for removing the alkaloids from the menstruum must be carefully regulated. Kerosene oil is recommended as the best medium for the exhaustion of coca and detailed directions are given for the carrying out of the assay. It is concluded that the coca leaf, to be of good quality, should assay by the process described about 0.7 per cent. of total alkaloids.

Digitized by Google

Assay of Crude Drugs. By H. M. GORDIN. *Am. J. Pharm.*, 73, 159–168; 211–220.—The author considers that a standard method for the assay of a given drug should be one in which the exhaustion is so complete that no alkaloid can be found in 5 grams of the dregs and further that the operations involved should be such as are not liable to injure the alkaloid in question. This question of a standard method has been worked out for some of the more important medicinal drugs.

The Assay of Belladonna Root and Its Solid Extract. By ARTHUR WAYNE CLARK. *Am. J. Pharm.*, 73, 22–29.—The essential feature of the method described consists in hot extraction of the drug, using a return-flow condenser. Consequently there is little resinous material extracted and the subsequent "shaking-out" is rendered easier. The process of assay is minutely described.

Adulterations of Essential Oils. By GEO. R. PANCOAST AND LYMAN F. KEBLER. *Am. J. Pharm.*, 73, 1–10.—The authors give a list of a number of essential oils with the adulterants usually found in them, together with a brief summary of the methods for their detection.

Thymoquinone in Wild Bergamot Oil. By I. W. BRANDEL AND E. KREMERS. *Pharm. Rev.*, 19, 200–203.—Thymoquinone has been found in wild bergamot oil (*Monarda fistulosa L.*), probably the first case in which this has been isolated from a volatile oil. The suggestion is made that the increased color of the oil on standing is due to the formation of colored derivatives of thymoquinone.

Hydrothymoquinone in Wild Bergamot Oil. By I. W. BRANDEL AND E. KREMERS. *Pharm. Rev.*, 19, 244–246.—The substance melting at 140°, previously reported by the authors as occurring in *Monarda fistulosa L.*, has been identified as hydrothymoquinone.

ORGANIC CHEMISTRY.

J. F. NORRIS, REVIEWER.

Orthophenylsulphonebenzoic Acid and Related Compounds. By HALL CANTER. *Am. Chem. J.*, 25, 96–110.—*o*-Tolylphenylsulphone (m. p. 68°), prepared by means of the Friedel and Crafts reaction from *o*-toluenesulphone chloride, was oxidized to *o*-phenylsulphonebenzoic acid. The acid is anhydrous and melts at 267°–268°. Graebe and Schulteiss, who claim to have made this compound by treating phenylthiosalicylic acid with strong nitric acid, state that it contains one molecule of water of crystallization and that it melts at 99° when hydrated and at 152° after being heated at 105°. The barium, magnesium, calcium, stron-

Digitized by Google

tium, zinc, copper, and sodium salts of *o*-phenylsulphonebenzoic acid were prepared. The chloride of the acid melts at 262.5°–263.5° and was converted into an amide, which sublimed and melted indistinctly at 220°–257°, and into an anilide, which melted at 234°–235°. *o*-Benzoyldiphenylsulphone was prepared by condensing the chloride of *o*-phenylsulphonebenzoic acid with benzene in the presence of aluminium chloride. The compound was found to be identical with the substance prepared by the same reaction from the chlorides of *o*-sulphobenzoic acid. The sulphone gave benzoic acid when it was fused with potassium hydroxide.

On the Importance of Formic Aldehyde as a Product of the Partial Combustion of Organic Compounds. By S. P. Mulliken, with J. W. Brown and P. R. French. *Am. Chem. J.*, 25, 111–117.—In studying a test for methyl alcohol Mulliken and Scudder (*this Rev.* 7, 82) showed qualitatively that formic aldehyde is one of the most common products of the partial oxidation of organic compounds by copper oxide, and that its appearance in minute traces as a result of such oxidation should not be accepted as sufficient proof that the substance burned contains a methoxyl group. In order to determine to what extent formic aldehyde is formed when organic compounds are partially oxidized, a quantitative study of the oxidation-products of a number of substances was made. The method of carrying out the experiments was that used by Loew for the preparation of formic aldehyde from methyl alcohol. The gaseous products of the reaction were collected in water. In order to separate the acetic aldehyde from the formic aldehyde formed, the solution of the gases was boiled in a flask provided with a return condenser. The acetic aldehyde, which was removed from the solution by this procedure, was condensed and determined. This method of separation was found to be simple and exact. The compounds chosen for oxidation were carefully purified. The amount of substance used in each experiment varied from 40 to 275 grams. The substances used and the per cent. yield of formic aldehyde in each case were as follows: acetone, 0.22; ethyl alcohol, 0.44; pentane, 0.88; acetic acid, 0.84; ethyl oxide, 1.86; amylene, 2.01; normal propyl alcohol, 2.72; trimethyl carbinol, 5.17.

On the Non-Existence of Trivalent Carbon. By James F. Norris. *Am. Chem. J.*, 25, 117–122.—The author, while studying the action of sodium on triphenylchlormethane, came to the conclusion that the metal caused the elimination of hydrogen chloride from the compound, and that a highly unsaturated compound was formed, which was identical with a substance previously described by Gomberg. According to Gomberg, who prepared the compound by treating triphenylchlormethane with zinc, the substance was a free radical, triphenylmethyl, $(C_6H_5)_3C$—,

Digitized by Google

the reaction consisting simply in the removal of the halogen atom from the compound. In order to test the view that hydrogen chloride was removed and not chlorine alone, the author studied the action of zinc on triphenylchlormethane dissolved in ethyl acetate, as this solvent has a marked effect on the removal of halogen atoms from organic compounds. The reaction took place readily, and hydrogen and hydrogen chloride were evolved. According to the view of Gomberg, the unsaturated compound unites directly with oxygen and is so converted into a peroxide of the structure $(C_6H_5)_3C—O—O—C(C_6H_5)_3$. According to the author, this compound could be formed only by the combined action of oxygen and water on the unsaturated hydrocarbon. A stream of dry air was drawn through a benzene solution of the unsaturated compound for twenty minutes and the peroxide was not precipitated. The author is of the opinion, therefore, that the action of metals on triphenylchlormethane consists in the removal of hydrogen chloride and not chlorine alone.

The Synthesis of Amines by the Use of Alkyl Salicylates. By ALFRED TINGLE. *Am. Chem. J.*, 25, 144–155.—It has been previously shown by the author that when alkyl salicylates are boiled with an excess of aniline, the alkyl group is introduced into the aniline molecule, a secondary aniline being produced, and carbon dioxide and phenol are formed. It was also shown that when dry ammonia is passed into boiling methyl salicylate, dimethylamine is produced, but no phenol is formed. The work described in the present paper was undertaken to find out, if possible, the mechanism of the synthesis. Dry ammonia was passed into boiling methyl salicylate for twenty hours and the non-volatile products of the reaction were separated and identified. These were found to be salicylamide and polysalicylic nitrile, which was present in very small quantity. With the ethyl and isoamyl esters a reaction took place very slowly, but in neither case was there any evidence of the formation of an amine. The action of aniline on methyl benzoate was next studied to determine whether an analogous reaction took place in this case. The sole product of the reaction was benzanilide, no amine being produced. It was found, however, that the reaction took place in the reverse direction. Benzoic acid and dimethylaniline, when boiled together for nine hours, yielded a mixture from which methyl benzoate was isolated. The reactions involved in these syntheses can be expressed by the following equation:

$$R.COOR' + C_6H_5NH_2 \rightleftharpoons R.COOH + C_6H_5NHR'$$

The reaction is a reversible one and the end-products are determined by the velocities in the two directions and the stability of the acid set free from the ester. In the case of the salicylates the acid liberated is readily decomposed into carbon dioxide and phenol when the reaction takes place in the presence of aniline,

Digitized by Google

but when ammonia is used, ammonium salicylate is formed, which is changed at the temperature of the reaction into salicylamide. When methyl salicylate and aniline in the molecular proportions of two to one, respectively, were boiled together for six hours the resulting basic oil consisted wholly of dimethyl aniline. To determine if the formation of substituted anilines in this reaction was dependent upon the fact that the acid set free from the ester was decomposed, the action of aniline on methyl *p*-hydroxybenzoate and the corresponding meta ester was studied. The meta compound gave the anilide and no substituted aniline, while the para compound gave phenol and methyl aniline or dimethyl aniline, according to the quantities of the substances used. Methyl *m*-hydroxybenzoate, prepared by Fischer's method, crystallizes in needles, which melt at 70°. The author explains the reactions by assuming that an intermediate addition-product of the ester and amine is first formed, and that this unstable compound breaks down into either a secondary amine and an acid or an alcohol and an anilide.

The Constitution of Benzene. By GEORGE M. RICHARDSON. *Am. Chem. J.*, **25**, 123–144.—The author discusses at some length the chemistry of benzene and its derivatives and has come to the conclusion that the formula of benzene, as put forward by Claus and modified by Loschmidt, is more in accord with the facts than is the centric formula. This conclusion has been reached by a study of the phenomena of substitution, reduction, and oxidation, and the effect of position of the substituting group upon the properties of a compound. A large number of apparently independent facts have been brought together and so grouped that interesting and important relationships have been brought to light. On account of its nature the paper can not be reviewed adequately in a brief space.

On the Action of Aromatic Sulphonchlorides on Urea. By IRA REMSEN AND W. W. GARNER. *Am. Chem. J.*, **25**, 173–190.—Some time ago Elander found that a compound of the formula $C_6H_5.SO.N_4H_5C_2O_2 + H_2O$ was formed when benzene sulphonchloride and urea reacted, at 100°, in the molecular proportion of one of the former to two of the latter. The authors have studied this condensation further, and have proved that the reaction-product is the benzene sulphonate of guanylurea. It is probable that in the reaction the sulphonchloride acts, in the first instance, as a dehydrating agent, thus causing the union of two molecules of urea with the elimination of water and the consequent formation of guanylurea. This liberated water converts a part of the sulphonchloride into the sulphonic acid, which, in turn, unites with the urea derivative to form a salt. The condensation-product was shown to be the benzenesulphonate of guanylurea by comparing it with a sample of the sulphonate pre-

Digitized by Google

pared by bringing together in aqueous solution benzenesulphonic acid and guanylurea. When the sulphonate was heated with dilute hydrochloric acid at 180°, it was decomposed ; carbon dioxide, ammonium chloride, and the benzenesulphonate of guanidine were formed. Fuming nitric acid converted guanylurea benzenesulphonate into nitroguanidine and nitrobenzenesulphonic acid. Analogous condensation-products were obtained by heating urea with *o*- and *p*-toluenesulphonchlorides and *α*- and *β*-naphthalenesulphonchlorides.

On the Action of Aromatic Sulphonchlorides on Thiourea. By Ira Remsen and H. J. Turner. *Am. Chem. J.*, **25**, 190–202.—The results obtained in studying the action of aromatic sulphonchlorides on urea, an account of which is given in the preceding review, led to an investigation of the reaction between benzenesulphonchloride and thiourea. In this case a complicated reaction was found to take place. A part of the thiourea abstracts chlorine from the sulphonchloride and unites with the halogen to form dithiourea dichloride, $(SC.N_2H_4)_2.Cl_2$. The residues of the two molecules of the acid chloride are reduced by two molecures of thiourea with the consequent formation of benzene disulphoxide. The reaction proceeds as follows :

$$2C_6H_5SO_2 + SC.N_2H_4 = (C_6H_5SO)_2 + 2CNNH_2 + 2S + 2H_2O.$$

This disulphoxide was found to be identical with the phenyl benzenethiosulphonate of Otto. The reactions take place so smoothly that they furnish an excellent method for the preparation of the disulphoxide. *p*-Toluenesulphonchloride reacted analogously with thiourea. The disulphoxides were also prepared by the action of dithiourea dichloride on the potassium salts of benzene and toluenesulphinic acids.

On the Action of the Chlorides of Orthosulphobenzoic and of Paranitroorthosulphobenzoic Acids on Urea. By Willis B. Holmes. *Am. Chem. J.*, **25**, 202–216. When the symmetrical chloride of *o*-sulphobenzoic acid was heated at 100° with urea, a reaction set in, which was complete at the end of several days. From the reaction-product was isolated a small quantity of biuret and ammonium chloride and a good yield of a well-crystallized compound which melted at 266° and proved to be the ammonium salt of benzoylurea-*o*-sulphonic acid,

$$C_6H_4\begin{cases} COHNCONH_2 \\ SO_2NH_4 \end{cases}.$$

On boiling with dilute hydrochloric acid this ammonium salt was hydrolyzed to the acid ammonium salt of *o*-sulphobenzoic acid ; when heated with a solution of potassium hydroxide the potassium salt of *o*-benzaminesulphonic acid was formed, and when treated in the cold with an excess of barium hydroxide the

Digitized by Google

barium salt of benzoylurea-*o*-sulphonic acid was the result. From this barium salt the potassium, sodium lead, copper, and silver salts were prepared. When the unsymmetrical chloride of *o*-sulphobenzoic acid was heated with urea, the same reaction-products were obtained as with the symmetrical chloride, but the reaction took place more readily. A study of the condensation of urea with the chlorides of *p*-nitro-*o*-sulphobenzoic acid led to perfectly analogous results. Improved directions for preparing the acid chlorides used and a probable explanation of the reactions above described are given.

On Trivalent Carbon. By M. Gomberg. *Am. Chem. J.*, 25, 317–334.—The author takes exception to the explanation of the action of zinc on triphenylchlormethane put forward by Norris (see review above) and describes experiments which were made to show that zinc removes chlorine alone from the halogen compound. When the ethyl acetate used as solvent during the reaction had been dried with great care over phosphorus pentoxide, the evolution of no hydrogen was observed and no free hydrochloric acid was found in solution. It was also discovered that when a stream of dry air was passed through a solution of the unsaturated compound for a day, the peroxide was precipitated. The author is of the opinion that the only explanation of the reactions is that put forward by him in an earlier paper, namely, that the metal withdraws the halogen from triphenylchlormethane and that an unsaturated radical of the formula $(C_6H_5)_3C$ — is formed in which the carbon is trivalent.

On Methyl Cyanide as a Catalytic Reagent; and a Criticism of J. U. Nef's Views on the Frankland, Wurtz, and Conrad Reactions. By Arthur Michael. *Am. Chem. J.*, 25, 419–430.—It has been found that methyl cyanide has a marked influence on the action of sodium on alkyl halides. Propyl iodide, for example, which Schorlemmer found did not react with sodium at the boiling-point of ether, when treated with a few drops of acetonitrile, reacted vigorously with the metal. From 310 grams of the iodide a yield of 80 per cent. of the theory of hexane was obtained. The nitrile was found to have an accelerating effect on the action of sodium on allyl iodide, isopropyl iodide, trimethylene bromide, and benzyl chloride. The catalytic property of methyl cyanide is shared by ethyl and propyl cyanides, although, particularly in the case of the last substance, the inductive capacity appears to be less developed, and with the aromatic cyanides, benzonitrile and benzyl cyanide, no acceleration of the reaction was noticed. The author points out the important fact that zinc ethyl iodide may be used in place of zinc ethyl in many syntheses. The formation of ethyl malonic ester by heating a mixture of ethyl iodide and malonic ester with zinc was shown to take place as follows: the zinc ethyl iodide, which

Digitized by Google

is first formed, reacts with the malonic ester and yields a metallic derivative, which, in turn, reacts with more ethyl iodide with the consequent formation of zinc iodide and ethyl malonic ester. Diethyl malonic ester accelerated the action between zinc and ethyl iodide and formed an addition product with the resulting zinc ethyl iodide. The author closes with a caustic criticism of the explanation by J. U. Nef, of the syntheses of Wurtz, Frankland, Conrad, and Daimler, and ridicules the elimination and addition theory which Nef has developed as a result of a great amount of experimental research.

On Thiourea-Amidines. By HENRY L. WHEELER. *J. Am. Chem. Soc.*, **23**, 223–237.—In a former paper (*J. Am. Chem. Soc.*, **22**, 365) Wheeler and Sanders described compounds prepared by the action of certain amines on thiourea-imido esters and acylthiourea-imido esters, which were considered to be thiourea-amidines. Further study has shown that the reaction-products are thiourea derivatives. Examples of thiourea-amidines have been prepared by combining benzenylphenylamidine with phenyl mustard oil and with benzoylrhodanide.

Compounds of Methyl Sulphide with Halides of Metals. By FRANCIS C. PHILLIPS. *J. Am. Chem. Soc.*, **23**, 250–258.—When methyl sulphide is added to solutions of various inorganic chlorides colored precipitates are formed. The following compounds, prepared in this way, are described: $PdCl_2(CH_3)_2S$, $3HgCl_2(CH_3)_2S$, $CuCl(CH_3)_2S$, and $AuCl(CH_3)_2S$.

On the Action of Alkyl Thiocyanates and Alkyl Isothiocyanates with Thiol Acids. By HENRY L. WHEELER AND HENRY F. MERRIAM. *J. Am. Chem. Soc.*, **23**, 283–299.—Thiocyanates react with thiol acids in at least two ways. Either a stable addition-product is formed, or hydrogen cyanide is evolved and a thiol ester results. The isothiocyanates react with thiol acids more energetically than do the thiocyanates. In this case the reaction takes place apparently in a quantitative manner as follows:

$$RNCS + HS.COC_6H_5 = RNH.COC_6H_5 + CS_2.$$

Not only the alkyl, but also the acyl isothiocyanates behave in this way. The difference in the behavior of the two forms of thiocyanates with thiol acids sharply distinguishes them from one another. The non-formation of carbon disulphide in this reaction may be taken as proof that the mustard oil form is not present. The authors tested a number of supposed derivatives of isothiocyanic acid and have come to the conclusion that neither isothiocyanacetic acid nor any of its derivatives have yet been prepared. Acyl imidodithiocarbonic esters were prepared by the action of alkyl iodides on the sodium salt of acetyl dithioethylcarbamate. These carbonic esters were converted into a new type of pseudo-

Digitized by Google

thioureas by the action of ammonia and organic bases. The behavior of acyl dithiocarbamic esters with ammonia and organic bases was also studied.

BIOLOGICAL CHEMISTRY.

Root Tubercles in Water Culture. By H. A. Weber. *J. Am. Chem. Soc.*, **20**, 9–12.—The question of the connection between root tubercles and the fixation of atmospheric nitrogen has thus far been studied only in connection with sterilized soil or sand. The author describes an apparatus employed for the water-culture of root tubercles, which presents certain advantages over methods previously used.

Nitric Nitrogen Produced by the Pea. By J. L. Beeson. *J. Am. Chem. Soc.*, **20**, 793–795.—Field experiments carried out with peas indicate that peas planted with a crop would tend to increase the yield of that crop under certain conditions. This is considered to be due to the nitric nitrogen assimilated from the air in the soil in excess of that required by the growing pea plant itself.

On the Preparation of Nucleic Acids. By P. A. Levene. *J. Am. Chem. Soc.*, **22**, 329–331.—For the preparation of the nucleic acids from nucleo-proteid as well as from paranucleo-proteids the author proposes a method based on the treatment of the tissues with acetates at a low temperature, precipitation of the proteid material by picric acid, and final precipitation of the nucleic acid from the acetate solution by alcohol.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. No. 9.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Department of Mining and Metallurgy at the McGill University, Montreal. BY CORRESPONDENT. *Eng. Min. J.*, 71, 514–516.—The paper describes with much detail the new mining and metallurgical laboratory, giving a plan of the same, and discusses in a general way the history of the department and its methods of instruction.

Stamp Milling of Free Gold Ores. BY D. HARMON. *Min. Sci. Press*, 82, 556–560.—The paper discusses, with illustrations, the practical details of milling gold ores; they are more of a mechanical than of a chemical nature.

Electro-Silvered Versus Plain Copper Plates. BY J. R. COOPER. *Eng. Min. J.*, 71, 331.—In the extraction of gold from its ores by means of the battery-amalgamating process, electro-silvered plates have replaced in most instances the plain amalgamated copper plates, as the latter become more or less tarnished with copper salts, which prevent amalgam or quicksilver from adhering. The author calls attention to the fact that all copper contains more or less cuprous oxide, and that, as this oxide does not combine with quicksilver, a plain copper plate can be only imperfectly amalgamated. Even if at first the whole plate is coated with quicksilver, this will break off from the oxidized parts and the latter be exposed to the action of water, oxygen, carbonic acid, etc.

Mackay's Amalgam Press. BY THE EDITOR. *Eng. Min. J.*, 71, 83–84.—The paper is an illustrated description of a piston-press worked by steam, air, or water. It removes in a better way than is possible by ordinary means the surplus quicksilver

Digitized by Google

from amalgam, thus enriching the amalgam and reducing the amount to be retorted.

When to Begin Treatment of Cyanide Tailings. By H. M. Crowther. *Eng. Min. J.*, 70, 732.—The tailings coming from mills which leach gold ores with potassium cyanide always retain more or less gold. If rich enough, they are re-treated directly, if not they go to waste or are perhaps stored to be re-treated at a later date, when the cost of working will be lower on account of the cheapening of labor and materials. The author found that by simply rewashing tailings from three to twelve months old from the dumps of the Mercur mine, Utah, containing 13.2 per cent. water and assaying $1.05, he obtained an extraction of 53.3 per cent. of the gold. Tailings usually retain at least ¼ lb. of potassium cyanide and somewhat more free caustic alkali per ton. If care is taken to add to the last wash-water from one to several pounds of caustic alkali the tailings will retain sufficient alkali to protect the residual potassium cyanide and allow it to have its solvent effect upon the residue in the tailings, which are being slowly affected by the action of air, moisture, and warmth.

The Agitation Process for Cyaniding Slimes. By C. S. Hurter. *Eng. Min. J.*, 71, 82–83. **Discussion.** By J. F. Webb. *Ibid.*, 144.—The paper is an illustrated description of the manner in which the pneumatic cyanide process is carried out at the works of the Cochiti Gold Mining Co., near Bland, N. M. Low-grade slimes, of which ninety-six per cent. will pass a 100-mesh sieve, are treated at a cost of $1.00 a ton with an extraction of eighty per cent. The slimes are agitated (in 3 to 3½ ton charges) in tanks nine feet in diameter and five feet deep (holding six tons solution with 0.15 per cent. potassium cyanide) for twenty-four hours with steam and compressed air which pass into the solution through a number of perforated pipes placed along the bottom of the vat. About sixty pounds of lime are charged into a wire bucket suspended to reach below the surface of the solution. The lime not only neutralizes any acid reaction of the pulp, but also aids later in settling the slimes. After treatment the pulp is run from the agitating tanks into "wire" settling tanks, placed in series, from which the overflow is made to pass through upward-filtering tanks before it goes to the zinc boxes. From the settling tanks the slimes are sluiced out into decanting tanks and allowed to settle for from twelve to twenty-four hours; the clear solutions, drawn off through openings in the side, are mixed with the liquors from the "wire" settling tanks before they pass through the filtering tanks.

One man in a 10-hour shift can do the work of a 20-ton plant; for agitation one-tenth of one horse-power a day is required per ton of ore. The consumption of reagents per ton of ore is one

Digitized by Google

pound potassium cyanide, twenty pounds lime, and one pound zinc. The cost of treatment is as follows :

Cyanide, 1 lb. at 31c	$0.31
Lime, 20 lbs., at $18 per ton	0.18
Zinc, 1 lb. at 12c	0.12
Tramming	0.04
Power, 0.1 H. P. at 40c	0.04
Labor, 0.05 day at $3.50	0.175
Extras, repairs, smelting, etc	0.135
Total cost per ton of pulp treated	$1.00

The Riecken Process for Treating Telluride and Sulphide Ores. By H. R. Cassel. *Eng. Min. J.*, 70, 664 ; 71, 47.—This process aims to extract coarse and fine gold from raw or roasted ores by means of a combination of amalgamation and lixiviation with potassium cyanide in a manner somewhat similar to that attempted in the electrochemical process of Pelatan-Clerici. The apparatus used consists of a horizontal stationary tank with stirring shaft having beaters. The tank, open at the top, has vertical ends, inclined sides, and a rounded bottom. The sides and bottom are lined with removable amalgamated copper plates, forming the negative pole ; the positive pole is stationary. A small pump, drawing its supply from a trap at the bottom of the tank, causes quicksilver to flow continuously over the amalgamated plates. The ore is charged with quicksilver and a dilute solution of potassium cyanide into the vat ; the coarse gold is amalgamated and the fine gold dissolved and electrically precipitated on the quicksilver cathode.

Pyritic Smelting and Hot Blast. By S. E. Bretherton. *Eng. Min. J.*, 70, 760–761.—The author, a strong advocate of pyritic smelting, claims that in comparison with lead smelting, pyritic smelting saves as high a percentage of gold and silver with a concentration of 8 to 15 tons of ore into 1 of matte with 50 to 60 per cent. of copper ; that it permits a higher degree of concentration in working ores with 1 to 2 per cent. copper ; and that it allows a larger percentage of zinc in the charge as well as a more silicious slag. The charges run by the author, using hot blast, contain 3 per cent. copper and over, 20 to 30 per cent. iron, 8 to 13 per cent. lime, not over 10 per cent. zinc, 10 per cent. alumina, 30 to 36 per cent. silica, 10 to 30 per cent. sulphur.

Pyritic Smelting and Hot Blast. By A. E. Bretherton. *Eng. Min. J.*, 71, 458.—The main point of interest in this paper is a dimensioned drawing of the author's blast-furnace and fore-hearth, with air-chamber and flues for superheating the blast by means of the waste heat of the fused matte and slag collecting in the fore-hearth.

Digitized by Google

The Province of Pyritic Smelting. By H. Lang. *Eng. Min. J.*, 71, 589-590; 617-618.—Pyritic smelting may be defined as a matting blast-furnace smelting process in which parts of the metallic sulphides are oxidized, thereby giving a more concentrated product. The degree of concentration depends mainly on the proportion of silica in the charge. As the silica increases the matte-fall decreases, as does also the smelting power, because slags when acid run more slowly than when basic. Thus a furnace with a charge rich in pyrite, run to form a basic slag, will give much low-grade matte and put through large quantities with little fuel. At Tilt Cove, Newfoundland, 3 tons pyrite were concentrated into 1 ton of matte, the furnace running without any coke and with cold blast. At Mount Lyell, Tasmania, heavy pyritic ore with 3 per cent. copper is smelted with silicious flux to a matte containing over 20 per cent. copper, *i. e.*, a concentration of six into one. The matte is smelted pyritically with silicious flux (raising the tenor of copper to 50 per cent., *i. e.*, a concentration of 2½ tons into 1) when it is Bessemerized. A furnace with a charge containing 35 per cent. pyrite, which is run to form an acid slag, will give a concentration of eight into one and put through a considerable amount of ore, but it will require about 5 per cent. coke and a blast heated to 250° C. A furnace running a charge with a deficiency of sulphides, or with a slag that is very silicious, loses most of its pyritic character and requires, of course, much larger quantities of coke, from 10 to 20 per cent. In pyritic work two-thirds of the coke can be replaced by the use of hot-blast.

The Leaching of Copper Ores. By J. Ohly. *Min. Sci. Press*, 82, 51-61.—This paper is a partial review of the subject written for the general public. Some of the reactions said to take place in roasting previous to leaching are at least doubtful; thus sodium sulphate and cupric silicate, when subjected to an oxidizing roast, will hardly form sodium silicate and cupric sulphate.

Modern Leaching Processes. By J. Ohly. *Min. Sci. Press*, 82, 168-169.—The general character of this paper is similar to that of the preceding one.

Name Plates. By E. S. Sperry. *Al. World*, 7, 74-75.—Name plates, *i. e.*, plates bearing the names of manufacturers of machinery, are usually cast of bronze or of aluminum; brass is sometimes used, but its color is not so pleasing as that of bronze; iron plates are unsightly. In order to obtain the right color the composition of the bronze is somewhat limited. The two following mixtures, copper 90 per cent., tin 8 per cent., zinc 2 per cent., and copper 92 per cent., tin 3 per cent., and zinc 5 per cent., give satisfactory castings. An alloy of aluminum with 6 per cent. copper also works well. The paper gives some practical details about casting these alloys.

Digitized by Google

Method of Making Alumina. By C. M. Hall. *Al. World*, 7, 75-76.—The new method of producing pure alumina consists in charging bauxite (calcined at a low heat if necessary), burnt lime, sodium carbonate, and water into a digester provided with a stirring mechanism and subjecting the mixture at a considerable pressure to an elevated temperature for from one to three hours. Insoluble carbonate and silicate and inert impurities of the bauxite, such as iron oxide, insoluble alumina, etc., will form a residue to be separated by filtration from the soluble sodium aluminate. From the latter, aluminum hydroxide is precipitated in the usual way by carbonic acid and filtered off; the filtrate, with its sodium carbonate, is concentrated by heating and used again with another charge.

Aluminum-Zinc Alloys. By J. W. Richards. *Al. World*, 7, 153-154.—Alloys containing equal parts of zinc and aluminum or more zinc than aluminum have no specially valuable mechanical properties; the case is different when aluminum prevails over zinc. The alloy 2 parts aluminum to 1 part zinc, that is, with 33⅓ per cent. zinc, is remarkable. According to Durand (*Science*, *1897*, p. 396), its strength equals that of cast-iron; it melts at about 425° C., fills the joints of a mold perfectly, does not oxidize readily, and takes a fine finish; it is brittle, but resists corrosion well. The author adds to the above that while his first castings showed a breaking strain of 18,000 to 24,000 pounds per square inch with no perceptible elongation, he has no difficulty at present in securing a tensile strength of 40,000 pounds. Such a casting resembles a high-carbon steel; it, however, works well under tools and does not require any lubrication. Its high specific gravity of 3.8 shows that a great contraction has taken place in the formation (*viz.*, 17 per cent.), which suggests a cause for its great strength. The alloy, 3 parts aluminum to 1 part zinc, that is, with 25 per cent. zinc, is the one most commonly used. It is softer than the alloy with 33⅓ per cent. zinc, has a tensile strength of 35,000 pounds, and is less brittle; its specific gravity is 3.4, showing a contraction of 14 per cent. With alloys containing less than 25 per cent. zinc, the strength and hardness decrease quickly; an alloy with 10 per cent. and less zinc can be forged, rolled, and drawn.

The Dominion Iron and Steel Co., Limited. By C. Kirchhoff. *Iron Age*, **66**, 18–22.—The paper is an illustrated description of the new iron and steel works in the process of erection near Sydney, Cape Breton. It will consist of four blast-furnaces (85 feet high, 20-foot bosh), ten 50-ton open-hearth furnaces, a 35-ton blooming mill, a coal-washing plant, and 400 Otto-Hoffmann by-product coke-ovens. The ore mined on Great Bed Island, Newfoundland, contains H_2O, 1.50–2.50; Fe, 54.43–57.84; SiO_2, 9.34–13.00; P, 0.744–0.835; S, 0.05–0.03. Good limestone is

Digitized by Google

quarried near the works. The following analyses are given as being characteristic of the unwashed and washed coal of the leading mines of the Dominion Coal Co., and of the coke produced from the washed coal.

GENERAL COAL ANALYSIS.

Raw coal.	Reserve mine. Per cent.	Caledonia mine. Per cent.	Dominion mine. Per cent.
Moisture	1.45	1.54	1.21
Volatile matter	32.45	30.86	31.89
Fixed carbon	60.45	62.91	61.49
Sulphur	1.64	1.50	1.56
Ash	5.65	4.69	5.41
Washed coal.			
Moisture	1.01	1.08	0.84
Volatile matter	32.99	33.92	37.86
Fixed carbon	62.21	61.69	62.60
Sulphur	1.11	1.07	1.17
Ash	3.79	3.31	4.50
Retort coke.			
Sulphur	0.91	0.78	1.01
Ash	6.07	5.38	6.24

Heat and Power from the Waste Gases of Blast-Furnaces. BY F. W. GORDON. *Iron Age*, **66**, 1–6.—The paper shows which part of the total heat generated by an iron blast-furnace is required by the furnace itself, and which is available for other purposes. The calculations are based on data of one of the South Chicago blast-furnaces published by the author in 1885 (*Trans. Am. Inst. Min. Eng.*, 14, 362).

Cast-Iron Car-Wheels. BY G. W. BEEBE. *Iron Trade Rev.*, **33**, 16-17.—The author calls attention to the small amount of damage done by the failures of cast-iron car-wheels, when it is considered that 10,269,924 such wheels are in use at present. He attributes this fact to the close inspection and to the thermal and drop tests exacted by the railroad companies, both of which are described in detail with illustrations. The thermal test requires that a sample wheel of a melt when cast under specified conditions shall not crack upon cooling; the drop test requires that the wheel, supported in a certain definite way, shall stand a number of blows from a hammer weighing 100 to 140 pounds and lifted 7 to 12 feet. The subjoined table gives the chemical composition of wheels that withstood the physical tests and that did not:

	Wheels that failed in thermal test.		Wheels that stood thermal test.		Wheels that failed under 50 blows, Barr drop.		Wheels that stood 50 blows and over, Barr drop.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Total carbon	3.91	3.03	3.90	3.38	3.87	3.42	3.93	3.49
Graphitic carbon	3.02	2.92	2.98	2.71	3.19	2.90	3.02	2.90
Combined carbon	0.89	0.71	0.92	0.67	0.68	0.52	0.91	0.59
Sulphur	0.090	0.042	0.60	0.080	0.080	0.020	0.070	0.05
Manganese	0.60	0.49	0.58	0.48	0.62	0.40	0.72	0.47
Silicon	0.82	0.50	0.91	0.50	0.97	0.67	1.10	0.68
Phosphorus	0.48	0.39	0.52	0.26	0.58	0.30	0.53	0.28

Digitized by Google

The Tropenas Process for Steel Castings. By The Editor. *Foundry*, 17, 237; *Eng. Min. J.*, 70, 761.—The paper contains a brief description of the Tropenas process with illustrations of converter and of castings.

Influence of Copper in Retarding Corrosion of Soft Steel and Wrought Iron. By F. H. Williams. *Eng. Soc. Western Pa.*, 26, 231, through *Iron Age*, 66, 16.—The experiments described were carried out in order to show what effects small additions of copper would have in retarding the corrosive effect of moisture on soft steel and wrought iron. For this purpose the specimens were cut and filed to the same dimensions, weighed, suspended on a frame, dipped together into water, and then left to hang in the air until dry. This treatment was repeated several times a day for a month, until the oxide-scale formed showed a tendency to peel off. The specimens were freed from oxide and then weighed. In the table below are given the percentage losses:

Loss from Atmospheric Corrosion.

	Loss in weight. Per cent.
A—Soft Bessemer steel	1.85
B—Soft Bessemer steel with 0.078 copper	0.89
C—Soft Bessemer steel with 0.145 copper	0.75
D—Soft Bessemer steel with 0.263 copper	0.74

Steel and Wrought Iron.

	Loss in weight. Per cent.
Soft Bessemer steel	1.65
Wrought iron, sample 1	0.76
Wrought iron, sample 2	0.80
Wrought iron, sample 3	0.87
Wrought iron, sample 4 (containing 0.393 per cent. copper)	0.53

They show that both soft Bessemer steel and wrought iron resist corrosion much better when they contain some copper than when they do not.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

W. O. Crosby, Reviewer.

On the Constitution of Barytocelestites. By C. W. Volney. *J. Am. Chem. Soc.*, 21, 386–388.—Although previous work had discredited the existence of a true barium-strontium sulphate, showing only barites containing a trace of strontium or celestites containing a trace of barium, the author finds this mineral from eastern Ontario to yield: $BaSO_4$, 30.850, and $SrSO_4$, 70.010. A previous analysis by the author had given: $BaSO_4$, 39.850, and

Digitized by Google

$SrSO_4$, 58.200. These results correspond very closely to the formulas $(BaSr_2)(SO_4)_3$ and $(BaSr_3)(SO_4)_4$. These two types of barytocelestites have distinct habits of crystallization which remain to be investigated.

Analysis of Emery from Virginia. By W. W. Miller, Jr. *Am. Chem. J.*, **22**, 212–213.—The emery occurs in a heavy ledge near Whittle's, on the line of the Southern Railroad, in Pittsylvania County. It is described as a black, crystalline mass, magnetic, polar, with specific gravity 4.205, and hardness 8. The analysis shows: alumina, 56.74; ferric oxide, 15.50; ferrous oxide, 20.77; silica, 0.68; titanic oxide, 1.86; soda, 3.95. The ferrous oxide, in excess of that required to form magnetite, is supposed to be present as hercynite, $FeAl_2O_4$; and the soda is considered to take the place of ferrous oxide in forming additional hercynite, thus greatly reducing the amount of alumina which can exist as corundum. The large amount of hercynite reduces the erosive power and makes the mixture of no value as emery.

Examination of a Sandstone from Augusta County, Virginia. By W. W. Miller, Jr. *Am. Chem. J.*, **22**, 216–217.—This sandstone is a disintegrated quartzite, occurring in the vicinity of Basic City, and found to be valuable for ballast and road metal. The analysis shows large proportions of alumina and alkalies, indicating partially kaolinized feldspar, which is regarded as explaining the packing of the material in use.

Analysis of Smithsonite from Arkansas. By W. W. Miller, Jr. *Am. Chem. J.*, **22**, 218–219.—The smithsonite from the Morning Star Mine, in Searcy County, is the usual botryoidal variety, and encloses layers of zinc blende from which, probably, it has been derived. The analysis shows it to be nearly pure, but with a little cadmium, copper and iron replacing zinc.

On the Interpretation of Mineral Analyses: a Criticism of Recent Articles on the Constitution of Tourmaline. By S. L. Penfield. *Am. J. Sci.*, **160**, 19–32.

C. H. Warren, Reviewer.

Nitrates in Cave Earths. By Henry W. Nichols. *J. Geol.*, **9**, 236–243.—This is, in the main, a criticism of the theory advanced by Hess (*J. Geol.*, **7**, 2) that the nitrates of cave earths are not derived to any extent from bat guano, as has been formerly supposed, but from the soil above by a leaching process followed by a deposition of the salts on evaporation. The chief objections raised by Hess to the old theory may be briefly summarized as follows: 1. Bats do not penetrate far into caves, which makes it difficult to account for the presence of salts derived from guano and their uniform distribution in the caves. 2.

Digitized by Google

Cave earths contain little or no organic matter. 3. While the total phosphates in the guano and underlying earth are about equal, the soluble phosphates are much less in the earth. In criticizing these objections it is shown that bats do penetrate into remote parts of the caves, that in some instances cave earths do contain organic matter, and that the lack of soluble phosphates in the earth is due to a simple reversion of the soluble to an insoluble form. Among other things to which attention is called is the presence of carbonates in the drip waters of the cave and their absence in the cave earths, a fact which Hess' theory does not account for. It is thought that the amounts of phosphates and nitrates taken into solution from the soil are too small to account for the amounts found in the earths and that the considerable quantities of soluble salts in the bat guano furnish a more probable source of supply. The author therefore concludes that the old theory agrees with the facts better than the new.

Mohawkite. By Joseph W. Richards. *Am. J. Sci.*, 161, 457–458.—Under the name mohawkite a mineral was described by Ledoux (*Eng. Min. J.*, Apr. 7, 1900) to which he assigned the formula $(Cu,Ni,Co)_4As$. Later the correctness of his work was called into question by Koenig, who appropriated the name mohawkite for a mineral which he described (*Am. J. Sci.*, Dec., 1900) as having the composition $(Cu,Ni,Co)_3As$. A new analysis is reported in the present paper, confirming the correctness of Ledoux's work and proving the existence of a molecule $(Cu,Ni,Co)_4As$. The name Ledouxite is proposed as a name for the latter.

On the Origin of the Phenocrysts in the Porphyritic Granites of Georgia. By Thomas L. Watson. *J. Geol.*, 9, 97–122.—A detailed petrographical study is given of the porphyritic granites of Georgia, within the Piedmont Plateau. The different areas are taken up according to their geographical distribution. The following facts given by the author concerning these rocks are believed to indicate that the phenocrysts (orthoclase) have been formed in place and are not of intratelluric origin: 1. The absence of a definite arrangement or orientation among the phenocrysts. 2. Absence of the phenocrysts from the border zones of the granite masses and a gradation peripherally from an interior porphyritic facies into an even-granular granite of coarse texture and of the same mineral and chemical composition. 3. The absence of any evidence of magmatic resorption or corrosion of the phenocrysts. 4. The absence of any flow structure. 5. The abundant inclusions of all the ground mass constituents, a feature very characteristic of these porphyritic granites. A table of the chemical analyses of these rocks accompanies the article.

Digitized by Google

Mineralogical Notes. By C. H. WARREN. *Am. J. Sci.*, **161**, 369–373.—The following minerals are described: Anorthite crystals, occurring as a contact mineral in the limestone at Franklin Furnace, N. J.; soda orthoclase crystals of peculiar habit from a phonolite dike, Cripple Creek, Colo.; iron wolframite crystals from South Dakota; pseudomorphs of wolframite after scheelite from Trumball, Conn.

Studies for Students. By O. C. FARRINGTON. *J. Geol.*, **9**, 51–66; 174–190.—This is a study of meteorites in regard to their chemical and mineralogical composition, their petrographical characteristics, their terrestrial analogies, and to some of the theories relating to their origin.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. NO. 10.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

ANALYTICAL CHEMISTRY.

PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

Contribution to the Chemistry of Rhubarb. By CARL G. HUNKEL. *Pharm. Archives*, 3, 201–216.—A study of some of the characteristic constituents of rhubarb, made especially with a view to determining the nature of the cathartic principle, the so-called cathartic acid.

A New Indicator for Use in Determining Total Acidity of Wines. By E. G. RUNYAN. *J. Am. Chem. Soc.*, 23, 402–405.—The indicator is prepared as follows: 3.1 grams of corallin are dissolved in 150 cc. of 90 per cent. alcohol, neutralized and mixed with 0.5 gram of malachite green dissolved in 50 cc. of alcohol. The color is purple with alkalies and green with acids. In using the indicator, 10 drops of it are added to 10 cc. of the wine, diluted to 300 cc. and boiled as usual, an excess of decinormal sodium hydroxide is added, and the excess of alkali titrated with decinormal acid.

The Detection of Methyl Alcohol in Presence of Ethyl Alcohol. By ALBERT B. PRESCOTT. *Pharm. Archives*, 4, 86–90.—In the method proposed the alcohols are first converted into aldehydes by oxidation with a red-hot copper spiral. The acetic aldehyde is then oxidized by hydrogen peroxide in excess, the excess being removed by sodium thiosulphate. The formaldehyde is finally tested for by the well-known Jorissen test, with phloroglucin in alkaline solution. The presence of one part of methyl alcohol in 20 parts of ethyl alcohol is shown by the test and ten or twelve minutes is required for its execution.

Digitized by Google

The Lloyd Reaction for Morphine. By JOSEPH L. MAYER. *Am. J. Pharm.*, 73, 353–355.—The author has made experiments with twenty of the more common alkaloids and finds that only three, heroin, morphine, and veratrine, show the "Lloyd" reaction, *viz.*, the gradual appearance of a violet-blue color when mixed with concentrated sulphuric acid in the presence of hydrastine. Of the three, veratrine is the only one which gives a cherry-red color with cold concentrated sulphuric acid. The other two are distinguished by nitric acid, with which morphine gives an orange-red color and heroin a yellow color.

On the Estimation of Urea in Urine. By J. H. LONG. *J. Am. Chem. Soc.*, 23, 632–638.—The chief source of error in estimating urea in urine by the Liebig method of titration with standard mercuric nitrate is the combination of a portion of the mercury solution with ammonia, uric acid, and creatinin. The author finds that the average correction to be made in 20 cc. of fresh urine (10 cc. urine and 10 cc. water) is 2 cc. of the mercuric solution. In older urine the effect of the ammonia formed by decomposition of the urea becomes too great to be easily corrected.

On the Determination of Formaldehyde. By A. G. CRAIG. *J. Am. Chem. Soc.*, 23, 638–643.—Preference is given to the Legler method, in which the formaldehyde is allowed to stand with excess of normal ammonia, the excess being titrated with standard acid and litmus. The author considers it best, however, to place the formaldehyde and ammonia in a bottle which can be tightly closed and heated in a boiling water-bath for an hour. The titration is made with normal sulphuric acid and methyl orange to the first indication of a color change. A blank determination is necessary, and in any series of results the higher ones are likely to be the better.

BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

The Rate of Nitrification of Some Fertilizers. By W. A. WITHERS AND G. S. FRAPS. *J. Am. Chem. Soc.*, 23, 318–326.—The order of nitrification in the soil used was, dried blood (greatest), dried fish, tankage, bat guano, bone, ammonium sulphate. This is, in general, the order of availability as shown by vegetation tests and digestion in potassium permanganate. Nitrification was greatly accelerated in the presence of calcium carbonate. The low rate of nitrification of ammonium sulphate is probably due to the selective action of the nitrifying organisms.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. NO. 11.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

Eighth Annual Report of the Committee on Atomic Weights. Determinations Published in 1900. BY F. W. CLARKE. *J. Am. Chem Soc.*, **23**, 90–95.—The average values are given below. For comparison those adopted by the author in his previous report are appended in parentheses. All values are referred to oxygen taken as 16.000. The wide divergence of the two values for krypton is unexplained.

Nitrogen, Dean	14.031	(14.04)
Calcium, Herzfeld (in 1897)	39.975	(40.1)
Iron, Richards and Baxter	55.89	(56.0)
Gadolinium, Benedicks	156.38	(157.0)
Thorium, Urbain	233.5	(232.6)
Yttrium, Muthmann and Böhm	88.97	(89.0)
Samarium, Demarçay	147.6	(150.3)
Krypton, Ladenburg and Krügel	58.74	.....
Krypton, Ramsay and Travers	81.76	.....
Helium, Ramsay and Travers	3.96	.....
Neon, Ramsay and Travers	19.94	.....
Argon, Ramsay and Travers	39.96	.....
Xenon, Ramsay and Travers	128.00	.....

A Table of Atomic Weights of Seventy-Seven Elements. BY THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, **36**, 544–545.—The only important changes in the table since last year (see *this Rev.*, **6**, 144) are the assignment of the value 238.5, instead of 240, to uranium, on the basis of work not yet published, done in the author's laboratory, and the insertion of the new elements, neon, krypton and xenon, with atomic weights 19.94, 81.7, and 128 respectively.

Digitized by Google

International Atomic Weights. By THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, 36, 171–176; *Am. Chem. J.*, 24, 377–383.—The author reports that the International Committee on Atomic Weights favor unanimously the appointment of a smaller committee to make a yearly revision, and approves by votes of about 40 to 8 the adoption of 16 parts of oxygen as the standard, and the retention of so many decimal places that the last figure is certain within half a unit. The author regards this last decision as unfortunate: he points out that it may introduce a very serious error (¼ per cent.) in some of the low atomic weights, one several times greater than exists in the determinations of them, and shows that it is quite irrational even from the standpoint of "common use," where a certain *percentage* accuracy (say 0.1 per cent.) is all that is ordinarily wanted. Therefore, if, as contended by the majority, adaptability to common use should be the guiding principle, only so many decimals should be retained as to secure, whenever possible, a certain percentage accuracy in the atomic weight value. To these objections the reviewer desires to add two others: first, that the refusal of the committee to recognize the gradual advances in accuracy which may be made tends to discourage the execution of exact atomic weight determinations; and second, that the deliberate disregard in this case of the scientific principles governing significant figures will make it more difficult than ever to secure proper recognition of those principles by chemical students and investigators.

The Standard of Atomic Weights. By THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, 37, 177–181.—Besides emphasizing the familiar fact that oxygen has served as the experimental standard of reference in the great majority of cases, the author contends that the argument that the hydrogen standard has pedagogical advantages is illusory, for the student usually learns by heart the old rule, "the molecular weight equals twice the specific gravity," without understanding it, while if densities are referred to oxygen and the corresponding factor 32 is employed, the reason for the relationship is more apparent. In closing, the author urges that, whatever one's personal opinion may be, the decision of the International Committee be respected.

The Atomic Weight of Antimony. By G. CLAUSEN FRIEND AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, 23, 502–505.—Potassium antimonyl tartrate, purified by ten recrystallizations, was heated to dull redness first in hydrochloric acid gas, next in oxygen, and then again in hydrochloric acid gas; the carbon was filtered off after dissolving in water, the solution evaporated, and the residual potassium chloride weighed. The mean of eight determinations gives 120.353 as the atomic weight of antimony (oxygen = 16.00).

Digitized by Google

On the Periodic System and the Properties of Inorganic Compounds. II. Gradations in the Properties of Alums. By JAMES LOCKE. *Am. Chem. J.*, 26, 166–185.—The author has determined the melting-point, and solubility in water at 25° (in a few cases also at 30°, 35°, and 40°), of many of the alums containing sodium, potassium, rubidium, cesium, thallium, or ammonium as the univalent metal, and aluminum, vanadium, chromium, iron, cobalt, or indium as the trivalent metal. He has also calculated their molecular volumes. The solubilities of the alums of any one trivalent metal decrease with the nature of the univalent metal in the order, sodium (atomic weight, 23), potassium (39), or ammonium (18), thallium (204), rubidium (85), cesium (133). Those of the alums of any one univalent metal decrease in the order, iron (atomic weight, 56), vanadium (51), chromium (52), aluminum (27). The melting-points increase in the same order in which the solubilities decrease, iron being preceded by indium (atomic weight, 114) and cobalt (59), two additional trivalent elements whose alums were investigated. The extent to which these two properties of the alums are a progressively varying function of the atomic weight will be seen by comparing the order given above with that of the atomic weights. In the case of the univalent metals, thallium, the only element belonging to a distinct group of the periodic system, forms a marked exception. In the case of the trivalent metals, while there seems to be a tendency to conformity with the principle, it is by no means a pronounced one. This becomes still more evident when one considers, in addition to the mere order of the elements, the fact that the differences between the properties of the aluminum and chromium alums are small, while those between the properties of the chromium and vanadium alums are very large.

The Effect of Temperature, of Colloidal Ferric Hydrate, and of a Magnetic Field on the Hydrolysis of Ferric Chloride. By H. M. GOODWIN AND FREDERICK W. GROVER. *Phys. Rev.*, 11, 193–214.—A study of the rate of the hydrolysis at 0°, 15.5°, and 25° shows that lowering of temperature diminishes very greatly the rate of formation of the colloidal hydroxide and increases the initial lag of the reaction (see *this Rev.*, 3, 22). The addition of colloidal hydroxide at the start entirely destroys this lag, and accelerates the reaction nearly in proportion to the amount added. This confirms the explanation previously given of the lag and remarkable acceleration of the reaction when once started, according to which the rate of formation of the colloidal hydroxide is dependent on the presence of some colloid particles which can serve as nuclei for the further development of the colloid. It is also shown that the rate of the hydrolysis is not appreciably affected by a magnetic field of 2000 lines per square centimeter.

Digitized by Google

A Spectrophotometric Study of the Hydrolysis of Dilute Ferric Chloride Solutions. By B. E. Moore. *Phys. Rev.*, 12, 151–176.—Measurements were made with a Brace spectrophotometer of the light-absorption caused by freshly prepared dilute ferric chloride solutions, of its change with the time, and of its limiting value. The absorption can be regarded as an approximate measure of the amount of colloidal ferric hydroxide, for the other molecules and ions present are much more transparent. The results are in general accord with those previously obtained by Goodwin (*this Rev.*, 3, 22 and preceding review) by the conductivity method. Namely, in very dilute solutions (0.0003 molar) the hydrolysis or colloid formation takes place with great rapidity, amounting to 50 per cent. in ten minutes, while at somewhat higher concentrations (0.0016–0.0024 molar) there is an initial period of inaction, followed by a rapidly increasing rate of hydrolysis. The solutions all hydrolyzed, however, considerably more rapidly than the corresponding ones of Goodwin. In 0.0003–0.0012 molar solutions the hydrolysis ultimately becomes complete, but stops at 80–87 per cent. in a 0.0012 molar solution.

On the Freezing-Points of Aqueous Solutions of Non-Electrolytes, II. By E. H. Loomis. *Phys. Rev.*, 12, 220–239.—After discussing the variation in the zero-point of his thermometer, the author gives the results of further freezing-point determinations (see *this Rev.*, 6, 142). The molecular lowerings calculated for one mol in a *liter* of *solution* are as follows:

	Molar concentration.				
Solute.	0.01.	0.02.	0.05.	0.10.	0.20.
Milk sugar.....	1.86	1.86	1.89	1.91	1.96
Maltose.....	1.93	1.89	1.89	1.92	1.97
Levulose.....	1.86	1.88	1.88	1.89	1.92
Dulcite	1.85	1.88	1.86	1.88	...
Acetamide	1.83	1.81	1.83	1.84	1.84
Salicine.....	1.83	1.87	1.87	1.87	...

All these substances except acetamide and perhaps maltose, like most of those previously studied, give the limiting value 1.86 as the dilution increases. The value calculated by van't Hoff's equation is also 1.86, if 79.3 be assumed as the heat of fusion of ice. With increasing concentration the values increase by a few per cent. in most cases; however, more nearly constant results are obtained if the molecular lowerings are calculated for one mol of solute in 1000 grams of solvent.

The Conductivities of Some Double Salts as Compared with the Conductivities of Mixtures of Their Constituents. By Charles F. Lindsay. *Am. Chem. J.*, 25, 62–69.—The author claims to have found that the conductivities of solutions prepared by dissolving in water the three crystallized double salts, potassium cadmium chloride, potassium nickel sulphate, and ammo-

Digitized by Google

nium magnesium sulphate, are less in ¼ to ⅛ molar solution by 1.3, 1.2, and 2.4 per cent., respectively, than the conductivities of solutions prepared by mixing the corresponding quantities of accurately analyzed solutions of the two constituents. The experiments were made in the same way in every respect with the two kinds of solutions, and the analyses of both are said to have been certainly accurate to 0.1 per cent. It is unfortunate, in an investigation of this kind, the value of which depends wholly on the exactness of the results, that the analytical data were not communicated. Moreover, no statement is made as to the time that elapsed between the preparation of the solutions and the measurement of their conductivities. The author also found, when a solution of the mixed constituents was evaporated to dryness and the residue redissolved, that the conductivity was less than before.

Contribution to the Study of Aqueous Solutions of Double Salts. IV. Iodides, Cyanides, Nitrates, and Sulphates. By HARRY C. JONES AND B. PALMER CALDWELL. *Am. Chem. J.*, **25**, 349–390.—In continuation of earlier researches (*this Rev.*, **6**, 1) the electrical conductivities of aqueous solutions of many double salts, at concentrations varying from molar up to a very high dilution, were measured and compared with the sums of the conductivities of the separate components of the salts, which were in most cases measured by the authors, but were in some cases derived from the work of other investigators. The percentage difference between the sum of the conductivities of the separate components and the conductivity of the double salt, in 0.1 normal solution, was found to be 23 per cent. in the cases of potassium cadmium iodide, strontium cadmium iodide, and potassium mercury cyanide, showing the existence in solution of a considerable quantity of the double salts. In the cases of the double sulphates of ammonium and magnesium, copper, ferrous iron, cadmium, or nickel, and of potassium nickel sulphate, at the same concentration, the differences were 11 to 14 per cent., again indicating, though much less conclusively, the existence of the double salts in solution. In the cases of the double nitrates of ammonium and neodymium, or praseodymium, the differences were very small (1.4–5.1 per cent.). The authors have also confirmed the results of Lindsay (see preceding review) with ammonium magnesium sulphate, and have investigated ammonium cadmium sulphate in the same direction with similar results. They have also studied the freezing-point lowering caused by some of the above-mentioned double salts and their components separately. The sum of the molecular lowerings of the components is greater than the molecular lowering of the double salt in 0.2–0.25 molar solution by 4.77° in the case of potassium mercuric cyanide, 0.47° in that of ammonium cadmium sulphate, and —0.30° in that of ammo-

Digitized by Google

nium praseodymium nitrate. Thus, about 2.5 (4.77 ÷ 1.86) molecules disappear when 2KCN and $Hg(CN)_2$ are brought together, which corresponds well with the formation of the complex salt $K_2Hg(CN)_4$ if allowance is made for its degree of dissociation, which is probably less than that of the potassium cyanide. The differences in the other two cases are not large enough to prove the formation of a complex salt. Potassium cadmium iodide, cadmium sulphate, praseodymium nitrate, and ammonium praseodymium nitrate exhibit a minimum molecular lowering at not far from 0.2 molar concentration (see *this Rev.*, **6**, 2).

A Modification of the Usual Method of Determining Transference Numbers, and an Investigation of the Influence of the Concentration on Their Values in the Case of Some Trilonic Salts. By ARTHUR A. NOYES. *J. Am. Chem. Soc.*, **23**, 37–57; *Phys. Rev.*, **12**, 14–42.—The modification consists only in adding, during the electrolysis, to the portions around the electrodes weighed quantities of acid and alkali solutions respectively of such a strength as to keep both the composition and concentration of the solution nearly constant. This enables, however, the electrolysis to be carried on much longer, thereby greatly increasing the accuracy of the results. By this method the transference numbers of potassium sulphate, barium nitrate, and barium chloride were determined in 0.2 and 0.04 normal solution. Those of the first two salts were found to differ only very slightly at the two concentrations, showing that the intermediate ions KSO_4' and $BaNO_3^{\cdot}$ do not exist in appreciable quantity. The transference number of barium chloride was found to increase greatly with increasing dilution, indicating the presence of complex ions like $BaCl_3'$ or $BaCl_4''$.

Studies on Solutions of Tin Salts. I. Electrical Conductivity of Solutions of Stannous Chloride and Hydrochloric Acid. II. The Oxidation of Solutions of Stannous Chloride by Means of Free Oxygen. III. The Course and Kinetics of the Reaction between Stannous Chloride and Oxygen. By S. W. YOUNG. *J. Am. Chem. Soc.*, **23**, 21–36, 119–147, 450–460.—I. The addition of stannous chloride is found, both at 25° and at 0°, to cause an increase in the conductivity of hydrochloric acid solutions when these are dilute (0.25–0.5 normal), but a decrease (of 3.6–4.7 per cent. for one equivalent of salt added per liter) when the acid solutions are concentrated (1- to 4-fold normal). In the latter solutions the absolute decrease of conductivity is nearly proportional both to the concentration of the ions of the hydrochloric acid and to that of the added stannous chloride; it seems to the reviewer that this fact, which is not sufficiently emphasized by the author, indicates that $SnCl_3'$ ions (corresponding to the complex acid $HSnCl_3$) are the main product of the action in the con-

Digitized by Google

centrated solutions; the author, however, considers it probable that there are two complex acids present, such as $HSnCl_3$ and H_2SnCl_4, and that the one predominates in the diluter, the other in the stronger, solutions. The increase of conductivity in the dilute acid solutions may well be due to hydrolysis, as the author suggests. The absolute decrease in conductivity caused by stannous chloride was found to be always less when the hydrochloric acid was replaced in part by potassium chloride, but the percentage decrease was greater when large amounts of potassium chloride were used. In one experiment made with potassium iodide (instead of chloride) a much greater decrease of conductivity occurred, indicating that the iodine acid ($HSnI_3$) is more stable.

II. The apparatus is first described which was used for shaking solutions of stannous chloride containing hydrochloric acid, with oxygen under constant (atmospheric) pressure, and measuring the amount of gas absorbed as the reactions progressed. As preliminary experiments did not yield satisfactory first-order constants and showed that the reaction was exceedingly sensitive to accidental catalytic agencies, such as tobacco smoke and contact with rubber, an investigation was first made of the effect of various catalyzers. It was found that brucine, morphine, nicotine, aniline, and potassium cyanide greatly retarded the reaction, and that rubber powder, sulphur, stannous sulphide, iron and copper salts, and alcohol accelerated it.

III. Stannous chloride solutions were oxidized rapidly by five different agents, and the increase in the conductivity of the resulting solution with time determined. In every case this was found to be considerable, indicating that stannic chloride is the first product of the oxidation and that this then slowly hydrolyzes. In the last part of the paper the mass-action equations are formulated which should express the velocity of a reaction, such as this appears to be, in which a substance (the hydrochloric acid) consumed by it is regenerated by a secondary reaction.

Catalysis in Concentrated Solutions. By J. M. Crafts. *J. Am. Chem. Soc.*, **23**, 236–249.—Metaxylenesulphonic acid was heated in sealed tubes, at 100°, with hydrochloric acid solutions containing from 10–38 per cent. of the gas, the rate of decomposition being determined by cooling the tube and measuring in a calibrated part of it the layer of xylene which separated. The velocity-constants are found to increase enormously with increasing concentration of the hydrochloric acid, for example, 35-fold, when the concentration is increased from 19 to 38 per cent., and nearly so as to form a geometrical progression when the corresponding changes in the acid concentrations form an arithmetical progression, thus recalling the effect of temperature on the rate of reactions, or the increase in the partial pressure of hydrochloric acid gas from its own solutions (see *this Rev.*, 4, 57). The last-men-

Digitized by Google

tioned parallelism seems to the reviewer especially significant, since the partial pressure of the vapor is an approximate measure of the (anhydrous and undissociated) HCl molecules in the solution. Experiments also showed that the addition of zinc chloride or sulphuric acid to the hydrochloric acid solution of the sulphonic acid greatly increased the rate of its decomposition; and the author suggests that the course of the reaction is perhaps to be explained by the hypothesis that it is only when the sulphonic acid molecules have been dehydrated that they are susceptible to hydrolysis. Fifty per cent. sulphuric acid was found to cause nearly as rapid a rate of decomposition as 25 per cent. hydrochloric acid, but, remarkably enough, nitric acid of a corresponding concentration causes a scarcely appreciable hydrolysis. A single experiment with the sulphonic acid of pseudocumene shows that it hydrolyzes somewhat more rapidly than that of metaxylene.

The Reaction between Chloroform and Potassium Hydroxide. By A. P. SAUNDERS. *J. Phys. Chem.*, 4, 660–674.—Six series of experiments were made on the velocity of the reaction mentioned in the title. Though the results are very irregular, they indicate that the reaction is one of the second, not one of the fourth, order; and, therefore, that it proceeds in successive stages.

On the Expansion of Certain Metals at High Temperatures. By LUDWIG HOLBORN AND ARTHUR L. DAY. *Am. J. Sci.*, 161, 374–390.—The linear expansion of bars of platinum, palladium, platinum-iridium, silver, nickel, constantan, wrought iron, and steel was measured between 0° and 750° or 1000° for each 250° (or 125°) interval.

On the Spectrum of the More Volatile Gases of Atmospheric Air Which Are Not Condensed at the Temperature of Liquid Hydrogen. By S. D. LIVEING AND J. DEWAR. *Am. J. Sci.*, 161, 154–161.—Besides communicating the experimental material relating to the subject named in the title, the authors state that they found that the gases referred to contained 43 per cent. of hydrogen, thus proving its existence in sensible proportion in the atmosphere.

Boiling-point of Liquid Hydrogen, Determined by Hydrogen and Helium Gas Thermometers. By JAMES DEWAR. *Am. J. Sci.*, 161, 291–301.—The boiling-point of hydrogen was previously determined only by a resistance-thermometer, which yielded the value —238.4°. In this result was involved the validity of an empirical law not tested for such low temperatures. The author has now determined it by measuring the pressure of hydrogen and of helium kept at constant volume, and finds it to be —252.5° or 20.5° absolute. By the same method that of oxygen is found to be —182.5°, in agreement with previous determinations.

Digitized by Google

The Nadir of Temperature and Allied Problems. By JAMES DEWAR. *Am. J. Sci.*, **162**, 168–172.—This article, which is an abstract by the author of a lecture given by him before the Royal Society, contains many new and interesting results. The melting-point of solid hydrogen is 16° absolute by the helium thermometer, 16.7° by the hydrogen thermometer. The lowest temperature yet measured (that obtained by the use of solid hydrogen) is 14.5°. The heat of vaporization of liquid hydrogen is about 200, the heat of fusion of the solid substance about 16 calories. The atomic heat of liquid hydrogen, and also that of liquid nitrogen, is about 6, in accordance with the Law of Dulong and Petit. The refractive index is 1.12, the theoretical value at the boiling-point being 1.11. Hydrogen, helium, and neon have been separated from air by two methods. Xenon and krypton can be separated from air without liquefying it by drawing it, under reduced pressure, through a spiral tube filled with glass wool and immersed in liquid air kept under exhaustion. Fifteen different electrical resistance-thermometers were studied down to the boiling-point of hydrogen; they give, at that low temperature, results widely divergent among themselves and higher than that given by a gas thermometer. Helium has not been liquefied, although it has been cooled, probably to 9°–10°, by expansion from 80 atmospheres while surrounded with solid hydrogen. Organic bodies are found to increase greatly in phosphorescence, and some crystals to become highly electrified, when cooled to 20°.

On the Separation of the Least Volatile Gases of Atmospheric Air and their Spectra. By S. D. LIVEING AND JAMES DEWAR. *Am. J. Sci.*, **162**, 207–215.—Two forms of apparatus used for the fractionation of liquid air are described. After most of the oxygen and nitrogen has distilled off, the remaining gases follow in the sequence, argon, krypton, xenon. The remainder of the article is devoted to a description of the spectra of krypton and xenon and their variation with the nature of the electric discharge.

I. On an Improved Method of Determining Latent Heat of Evaporation and on the Latent Heat of Evaporation of Pyridine, Acetonitrile, and Benzonitrile. II. The Latent Heats of Evaporation of a Number of Organic Nitrogen-Bearing Compounds. By LOUIS KAHLENBERG. *J. Phys. Chem.*, **5**, 215–232; 284–288.—The author has modified the apparatus of Berthelot (*Mécanique chimique*, I, 289) by substituting for the flask-shaped boiling vessel heated by a gas flame a large test-tube heated by passing an electric current through a platinum spiral placed in the liquid within the tube. The top of the tube is closed by a cork stopper, and the vapors pass into the calorimeter beneath through a narrow glass tube fused into the bottom of the boiling

Digitized by Google

tube and extending nearly to its top, as in Berthelot's apparatus. Determinations to test the apparatus were made with water, benzene, ethyl alcohol, and ethyl iodide, formate, and acetate; the duplicate results were found to agree always within a few tenths per cent. Four determinations of the heat of vaporization of water gave 535.7 ± 0.4 cal., in agreement with the results (536.2, 537.7, and 536.6) of other recent investigators. The heats of vaporization H (and incidentally the specific heats) of eight organic nitrogen compounds were then determined, and from these were calculated the molecular rises of boiling-point and the Trouton constants (that is, the ratios of the molecular heats of vaporization, MH, to the absolute temperatures of the boiling-points, T). The results are given in the following table:

	H.	T.	$\frac{0.02\,T^2}{H}$.	$\frac{MH}{T}$.
Pyridine	104.0	387°	28.8°	20.5
α-Picoline.....	90.75	402	35.61	21.0
Acetonitrile	173.6	353.5	14.39	20.1
Valeronitrile	95.95	402	33.69	19.8
Benzonitrile.....	87.7	462	48.67	19.5
Amylamine	98.75	368	27.42	23.3
Dipropylamine ...	75.69	381	38.35	20.0
Diisobutylamine..	65.85	407.5	50.43	20.8

The Surface-Tension of Water above 100° C. By Chas. T. Knipp. *Phys. Rev.*, 11, 129–154. The author first describes in detail the construction of a platinum-plated steel bomb capable of withstanding pressures and temperatures above the critical ones of water. The bomb is closed below by a small perforated plug connected with a pressure gauge, and above by a large plug through which insulated circuits are introduced. One of these consisted within the bomb of a coil of wire, in whose axis was an iron core attached to a thin platinum vane, while two other circuits served to indicate the level of the water and the rising of the vane. The current which had to be passed through the coil in order to raise the vane out of the liquid into the vapor was shown to be a measure of the surface-tension. The decrease in surface-tension is found to be very closely proportional to the increase of temperature between 0° and 300°. Above 300° the decrease is somewhat less rapid, except in the immediate neighborhood of the critical temperature where it is extremely rapid. The density of the saturated water vapor was also determined by measuring the current required to hold the core and vane in suspension in the vapor, but the results are regarded only as preliminary. The bomb may also be used, after replacing the plug carrying the vane and electric circuits by a simple one, for determining the vapor-pressure of water at high temperatures, and its critical temperature and pressure. The vapor-pressure values in atmospheres are 9.6 at 180°, 15.5 at 200°, 23.0 at 220°, 33.6 at 240°, 47.1 at 260°,

Digitized by Google

65.9 at 280°, 89.0 at 300°, 120 at 320°, 160 at 340°, and 205 at 359°, the critical temperature. The critical pressure and temperature were obtained by noting the point at which the pressure-temperature curves began to diverge, when different quantities of water were present in the bomb.

Thermodynamic Notes: Revision of Some Thermal Data Concerning Benzene. By K. Tsuruta. *Phys. Rev.*, 10, 116–122.—The article contains no new experimental material, but discusses the existing data on the vapor-pressures of benzene, its specific volumes in the state of liquid and saturated vapor, and its heat of vaporization, between 10° and 270°, and also the vapor-pressures of liquid and solid benzene below its freezing-point. The most probable values of these constants are derived.

A Determination of the Viscosity of Water. By E. R. Drew. *Phys. Rev.*, 12, 114–120.—The apparatus used consisted essentially of two vertical coaxial cylinders, the outer capable of rotating at any desired speed, while the inner, which is closed at the ends, is suspended by means of a torsion wire between agate bearings in the axis, the liquid being contained in the space between the two cylinders. The coefficient of viscosity was found to be 0.01020–0.01023 dyne at 20°, while Poisseule previously found 0.0101.

On the Density of Ice. By H. T. Barnes. *Phys. Rev.*, 13, 55–59.—Contrary to the results of Nichols (*this Rev.*, 5, 50), the author was not able to detect any difference between the density of fresh river ice and that of ice which was one or two years old. The author's final value is 0.91661 ± 0.00007. Nichols' results varied for different samples from 0.9162 to 0.9181.

The Specific Heat of Solutions Which Are Not Electrolytes, II. By William Francis Magie. *Phys. Rev.*, 13, 91–101.—In continuation of his previous investigation (*this Rev.*, 6, 11), the author has determined the specific heat of aqueous solutions of various isomeric sugars and of both aqueous and alcoholic solutions of the three dioxybenzenes and of phenol. He finds that the molecular heats of many of these isomers in aqueous solution differ by 7–20 per cent. from one another, and that those of the same substance differ markedly in the two solvents, but are constant in the same solvent at different concentrations between 0.1 molar and molar.

On the Solubility of Manganous Sulphate. By F. G. Cottrell. *J. Phys. Chem.*, 4, 637–656.—This investigation was undertaken in order to explain the remarkable results previously obtained with this salt by Linebarger (*Am. Chem. J.*, 15, 225). His solubility determinations are shown, however, to have been erroneous, owing to the dehydration of the salt at too low a tem-

Digitized by Google

perature (170°) before weighing. While Linebarger obtained all seven hydrates, containing from 1 to 7 molecules of water, the author was able to obtain only those with 1, 4, 5, and 7 molecules. He has made 94 solubility determinations with these four hydrates at temperatures between — 10° and + 100°. There is nothing peculiar about the results, except that the monohydrate reaches equilibrium with its solution very slowly.

The Solubility of Manganous Sulphate. By THEODORE WILLIAM RICHARDS AND FRANK ROY FRAPRIE. *Am. Chem. J.*, **26**, 75–80; *Proc. Am. Acad.*, **36**, 509–514.—The solubility of the pentahydrated salt at 25° and that of the tetrahydrated salt at 30.15° and 35° were determined. The results confirm those of Cottrell (see preceding review) which differed greatly from the earlier ones obtained by Linebarger.

A Study of Growing Crystals by Instantaneous Photomicrography. By THEODORE WILLIAM RICHARDS AND EBENEZER HENRY ARCHIBALD. *Am. Chem. J.*, **26**, 61–74; *Proc. Am. Acad.*, **36**, 341–353.—The apparatus used consisted of a compound microscope connected above with a vertical folding camera, through a dark box containing a revolving shutter. With this apparatus, instantaneous photographs were taken, at regular intervals, of crystals separating from saturated solutions of high-melting salts, such as barium chloride, sodium nitrate, potassium iodide. The authors were unable to confirm the hypothesis that the separation of such crystals is preceded by that of liquid globules, although a globule 0.001 mm. in diameter would have been detected. They studied also the rate of growth of crystals and found that the cube of the diameter of a crystal is approximately proportional to the time elapsed since its separation from the solution; in other words, that equal increments of time correspond to equal increments of *volume*. The authors state this law with some reserve, however, owing to the approximate character of their results; but there is no doubt that the increase in diameter is extremely rapid in the early stages of growth. The article is illustrated by a diagram of the apparatus and by fourteen series of photographs of growing crystals.

The Boiling-Point Curve for Mixtures of Ethyl Alcohol and Water. By WILLIAM A. NOYES AND R. R. WARFEL. *J. Am. Chem. Soc.*, 23, 463–468.—Determinations of the boiling-point under the atmospheric pressure were made throughout the whole range of concentration, but with especial care for mixtures containing from 92 to 100 per cent. of alcohol. A minimum boiling-point was found to exist at 78.174° (0.126° below that of pure alcohol) for a mixture containing 96 per cent. of alcohol by weight or 97.45 per cent. by volume.

Digitized by Google

Vapor-Pressure Relations in Mixtures of Two Liquids, III. By A. Ernest Taylor. *J. Phys. Chem.*, 4, 675–689.—This paper is a discussion of the experimental results previously communicated (*this Rev.*, 6, 146) on the composition of the vapor given off by mixtures of acetone and water. It is shown that, as long as the liquid does not consist of more than 60 per cent. of acetone, the composition of the vapor agrees within 1–2 per cent. of the observed values when calculated by the formula for vapor pressure lowering

$$\left(\log \frac{p_0}{p} = \frac{n}{N} \right)$$

regarding the water as solvent; but that widely divergent results are obtained at all concentrations when the same calculation is made under the assumption that acetone is the solvent. This is probably due to the fact that liquid acetone molecules are simple, while those of water are associated. Henry's Law does not hold for either component, unless associated molecules are assumed for it; and the results are not accurate enough to make possible a satisfactory testing of this assumption.

Minimum Boiling-Points and Vapor Composition. By Morris R. Ebersole. *J. Phys. Chem.*, 5, 239–255.—The boiling-points of mixtures of benzene and acetone throughout the whole range of concentration from 0 to 100 per cent. were determined, as well as the composition of the vapor distilling from such mixtures. No constant-boiling mixture exists. In order to test Bancroft's hypothesis that two components whose vapor-pressure curves intersect at any temperature always give rise to a mixture with a maximum or minimum boiling-point, whatever may be the pressure, the author has tabulated all the pairs of substances whose vapor-pressure curves are known to intersect, and finds that only 20 out of 25 of them form a constant boiling mixture and thus conform to the hypothesis. The pairs of substances whose vapor-pressure curves do not intersect are also tabulated, and certain of these are shown to form mixtures with a maximum or minimum boiling-point.

Solvent Action of Vapors. By A. T. Lincoln. *J. Phys. Chem.*, 4, 715–731.—It is found that the distillates under atmospheric or reduced pressure from saturated aqueous, benzene, and acetone solutions of benzoic and salicylic acids do not contain more of these acids than corresponds to their partial pressures, whence it is concluded that the vapors have no appreciable solvent action upon them. The same is true of ethyl alcohol solution of camphor and naphthalene. Incidentally the vapor-pressures of benzoic and salicylic acids were determined up to 157° and 193° respectively.

Digitized by Google

Reaction Velocity and Equilibrium. By WILDER D. BANCROFT. *J. Phys. Chem.*, 4, 705–708. In this paper is considered the relation between the expression for the velocity and that for the equilibrium of a reaction taking place in successive stages.

Dissociation Studies, II. By WILDER D. BANCROFT. *J. Phys. Chem.*, 5, 182–192.—In this paper are discussed the data already existing in regard to the transformations of acetaldehyde, paraldehyde, and metaldehyde into one another under the influence of catalytic agents.

Toxic Action of Electrolytes upon Fishes. By LOUIS KAHLENBERG AND HUGO F. MEHL. *J. Phys. Chem.*, 5, 113–132. Rock-bass, shiners, brook-trout, and perch were placed in solutions of different electrolytes of various concentrations, and the time required to cause death was noted. Hydrochloric and nitric acids were found to be equally toxic, while sulphuric acid had to be of nearly twice the equivalent concentration to produce the same effect. Silver nitrate and sulphate were equally toxic, and were capable of producing death quickly even at a very slight concentration (0.00001 normal). Potassium cyanide and mercuric chloride were also highly toxic. On the other hand, even 0.01 normal solutions of the sulphates of copper, nickel, cadmium, and zinc had only a slow action, and magnesium sulphate, which was investigated in normal solution, was remarkably inert.

The Theory of Electrolytic Dissociation as Viewed in the Light of Facts Recently Ascertained. By LOUIS KAHLENBERG ASSISTED BY ARTHUR A. KOCH AND ROY D. HALL. *J. Phys. Chem.*, 5, 339–392. In this article are presented new conductivity determinations at 0° and 95°, between the concentrations of fourfold normal (or normal) and $^1/_{2000}$ (or $^1/_{8000}$) normal, of 19 common salts in aqueous solution, together with the boiling-point raising produced by all these salts, and the freezing-point lowering caused by many of them, at concentrations extending upwards from 0.1 or 0.2 normal. In the 0.1–0.2 normal solutions the agreement between the dissociation-values calculated from the conductivity and those from the freezing-point is satisfactory in many cases, though not in all. In the strong solutions (1.0–2.0 normal) there is no correspondence between them; thus for the bivalent-metal sulphates, the conductivities indicate 20–26 per cent., the freezing-points no dissociation whatever. Values still more discordant with the conductivity are derived from the boiling-point determinations; thus the halides of the alkali and alkaline-earth metals seem to be more than completely dissociated in two- to fourfold normal solutions. All the disagreements, which the author regards as strong arguments against the Dissociation Theory, are, however, based on the highly improbable assumption that the freezing-point lowering or boiling-point

Digitized by Google

raising is still a measure of the molecular weight at concentrations where the osmotic pressure is 20–100 atmospheres. Other arguments of the author against the Dissociation Theory are its failure to give a sufficiently simple explanation of certain physiological results (see *this Rev.*, 6, 73, 147, 157), the invalidity of the Mass Action Law, the exceptions to the Nernst–Thomson rule in regard to dielectric constants and dissociating power, and the behavior of the electrical conductivity of non-aqueous solutions. The author's view seems to be that because the theory does not alone explain all the relevant phenomena of all kinds of solutions, it is unjustifiable or inadvisable to employ it at all. It is scarcely necessary for the reviewer to add that the theory has received far too many approximately quantitative verifications to be overthrown by such facts as are cited by the author.

On the Heat Evolved when Liquids are Brought in Contact with Powders. By C. E. Linebarger. *Phys. Rev.*, 13, 48–54. —Two grades of precipitated silica, having particles whose average diameters were nearly in the ratio 2 : 1, were thoroughly freed from absorbed gases and treated within a calorimeter with five different liquids. The heat effect per gram of powder is independent of the quantity of liquid, after a certain minimum quantity has been added. It was found nearly twice as great for the particles of half the diameter with all of the liquids investigated, except benzene. The heat evolved per gram of silica in the case of the sample with the finest particles was as follows: 13.80 cal. with water, 12.15 cal. with pyridine, 11.05 cal. with nitrobenzene, 8.58 cal. with toluene, and 4.09 cal. with benzene.

The Exact Relation between Osmotic Pressure and Vapor Pressure. By Arthur A. Noyes. *Phys. Rev.*, 12, 84–99.— The author shows by the consideration both of a new cyclical process and of the equilibrium conditions of an osmotic column that the exact thermodynamic relation between the osmotic pressure (P_1) and the vapor-pressure (p_1) of a solution under the pressure of its own vapor is given by the equation

$$\int_{p_1}^{p_0} v dp = (P_1 + p_0 - p_1)\ V_0\ [1 + \tfrac{1}{2}\ (P_1 + p_0 - p_1) k_0],$$

in which p_0, V_0, and k_0 are the vapor-pressure, specific volume, and compression-coefficient, respectively, of the solvent. Except for high concentrations, the term containing k_0 can be neglected, and ordinarily $p_0 - p_1$ is entirely negligible in comparison with P_1; the second member of the equation then becomes simply $P_1 V_0$, showing that the approximate osmotic pressure is calculated correctly by dividing the vapor-pressure integral by the specific volume of the solvent, and not, as has generally been done heretofore, by dividing it by the volume-change which occurs when one gram of solvent is added to a very large quantity of solution.

Digitized by Google

The Formula for the Depression of the Freezing Temperature of Solutions. By WILLIAM FRANCIS MAGIE. *Phys. Rev.*, 12, 240–244.—The author derives, by the consideration of a reversible cyclical process and application of the energy and entropy equations to it, a relation between osmotic pressure, freezing-point lowering, heat of fusion, and specific heats, which, aside from certain enumerated and unimportant approximations involved, he regards as an exact one. The reviewer would, however, call attention to the fact that it is inaccurate in so far as the neglect of the effects connected with the compression of the solution introduces an error, and that the osmotic pressure involved is that of the compressed solution, not that of one standing under its own pressure (see *Phys. Rev.*, 12, 84). The author discusses the differences between his formula and the ordinary approximate one of van 't Hoff, and concludes that the direct proportionality required by the latter between osmotic pressure and freezing-point lowering is, in the case of aqueous solutions of even normal concentration, closer than the accuracy of the experimental determinations of the freezing-point requires.

The Dissociating Power of Different Solvents. A Summary. By HARRY C. JONES. *Am. Chem. J.*, 25, 232–249.—This article contains no original experiments, but is a comprehensive review of the subject, accompanied by numerous references to the original papers.

Becquerel Rays, a Resume. By OSCAR M. STEWART. *Phys. Rev.*, 11, 155–175.—This article is recommended to the attention of those who desire a full and connected account of the recent work on the subject of the title.

I. Gibbs' Thermodynamical Model. II. Gibbs' Thermodynamical Model for a Substance Following van der Walls' Equation. By W. P. BOYNTON. *Phys. Rev.*, 10, 228–233; 11, 291–303.—In the first article the author calls attention to certain difficulties which he has met with in the construction of a model which will fully represent the properties of actual bodies. In the second, the equation of the model is deduced in terms of the reduced volume, energy, and entropy which serve as the coordinates of the surface. Computations are made for the case of a triatomic gas like water or carbon dioxide, and the resulting model is discussed.

A New Conception of Thermal Pressure and a Theory of Solutions. By GILBERT NEWTON LEWIS. *Proc. Am. Acad.*, 36, 145–168.—The author first shows thermodynamically the applicability of Poynting's equation, $dP_2 = \frac{v_1}{v_2} dP_1$, to all cases in which any two phases, whether solid, liquid, or gaseous, of a single

Digitized by Google

component are in true equilibrium with each other ; in this equation dP_1 is the change of pressure upon one phase, dP_2 is the change of pressure on the other phase necessary to restore equilibrium, and v_1 and v_2 are the specific or molecular volumes of the two phases respectively. For example, if at 0° the pressure upon ice is increased by one atmosphere, that upon water must be increased by 1.09 atmospheres, if it is to remain in equilibrium with the ice at that temperature; for the specific volumes of the two are as 1.09 : 1. If one of the phases is a vapor that obeys the laws of a perfect gas $v_1 = RT : P_1$, and the above equation becomes $\frac{dP_1}{P_1} = \frac{dP_2}{RT : v_2}$, which expresses the remarkable result that the fractional increase of vapor-pressure is equal to the ratio of the increase of pressure upon the liquid or solid phase to the pressure which that phase would exert if its pressure were calculated from its molecular volume and temperature by the laws of Boyle and Gay-Lussac. This last hypothetical pressure the author designates thermal pressure ; for he assumes that it (instead of $\frac{1}{2}$ mu^2) is the true measure of temperature, and that it represents the pressure in the interior of a body on either side of an imaginary plane of unit area, and is equal to $n\,m\,u$ where n is the number of molecules passing in one second through that area. With the help of these assumptions, the laws of vapor-pressure lowering and of osmotic pressure are deduced. In the closing part of the paper, the relation of the theory to the equation of van der Waals' is considered.

Suggestion Regarding the Nomenclature of Heat Capacity. By THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, 36, 327–329.—The author suggests the adoption of a unit of heat capacity, to be designated the *mayer* and to be defined as the heat capacity possessed by any body which is heated 1° by one joule of heat energy. He considers that the adoption of this unit will facilitate the replacement of the calorie by the joule, and will assist students in discriminating between heat energy and heat capacity. He shows that the unit has a convenient magnitude.

The Possible Significance of Changing Atomic Volume. By THEODORE WILLIAM RICHARDS. *Proc. Am. Acad.*, 37, 3–17.—The author considers that the ratio (P) of the heat ($C\,dt$) imparted to a body to the change in volume (dv) produced by it represents the resultant inward tendency which opposes expansion by heat and other causes, and suggests that this is an approximate measure of the affinity of the particles for one another. Similarly, the increases of volume which a series of metals undergo when a definite other element (for example, oxygen or chlorine) combines with them are an indication of the relative chemical affinities involved, provided allowance be made for the

Digitized by Google

different degrees of compressibility of the metals themselves. A number of concrete illustrations are cited. In closing, the author contends that the atomic hypothesis should be so modified as to take into account the compressible environments (the atomic shell) around the centers of gravity and of affinity.

The Two Specific Heats of Gases. By W. P. Boynton. *Phys. Rev.*, **12**, 353–358.—The author deduces the corrections to be applied in calculating from the gas constant, from the velocity of sound, or from an adiabatic expansion, the specific heat ratio of an imperfect gas which conforms to van der Waals' equation.

Catalysis and Chemical Energy. By Oscar Loew. *J. Phys. Chem.*, **4**, 657–659.—The author assumes that the action of many catalytic agents is due to the presence in them of labile atoms or groups which undergo violent oscillations under the influence of the heat energy of the surroundings, and thereby loosen the affinities of other compounds.

I. On the Equilibrium of Chemical Systems. II. On a Theorem of van der Waals'. III. The Fundamental Equation of a Multiple Point. IV. On a Property of the Pressure Volume Diagram. V. On Clapeyron's Equation. VI. On a Theorem of Le Chatelier. VII. On a Theorem of Roozeboom. VIII. On the Generalization of Clapeyron's Equation. IX. On the Phase Rule. By Paul Saurel. *J. Phys. Chem.*, **5**, 21–65, 137–140, 170–178, 179–181, 256–258, 277–280, 281–283, 393–400, 401–403. **On the Liquefaction of a Mixture of Two Gases. Composition of the Liquid and of the Vapor.** By P. Duhem. *J. Phys. Chem.*, **5**, 91–112. **A Class of Relations between Thermal and Dynamic Coefficients.** By George H. Burrows. *J. Phys. Chem.*, **5**, 233–238. **Note on the Fundamental Equations of Multiple Points.** By J. E. Trevor. *J. Phys. Chem.*, **5**, 259–260.—These are all purely mathematical papers dealing with various principles of physico-chemical equilibrium.

The Preparation of Osmotic Membranes by Electrolysis. By H. N. Morse and D. W. Horn. *Am. Chem. J.*, **26**, 80–86.—In this preliminary notice the following method of preparing an osmotic membrane is described: A porous battery cup is first freed from air by filling it with a 0.05 per cent. potassium sulphate solution, placing it in a beaker containing the same solution, and passing an electric current into the cup until 300 cc. of liquid have entered it, as a result of endosmose. The cup is then provided with a platinum electrode and placed in another beaker containing a cylindrical copper electrode. After both electrodes are connected with a dynamo, a 0.1 normal copper sulphate solution and a 0.1 normal potassium ferrocyanide solution are poured simultaneously into the beaker and porous cup, respectively. The

Digitized by Google

electrolysis is continued until the cup exhibits a high resistance. These membranes were tested by filling the cups with sugar solution and connecting them with open vertical tubes or with closed mercury manometers; they withstood a pressure of 4.5 atmospheres, but have not been tested beyond that point owing to mechanical difficulties in making a tight union between the cup and manometer. Moreover, they have not yet been employed for osmotic pressure measurements.

An Electrically Heated and Electrically Controlled Thermostat. By S. W. Young. *J. Am. Chem. Soc.*, **23**, 327–330.—The bath is heated by incandescent lamps beneath, through which the main current passes after having traversed a telegraphic sounder in which the circuit is made and broken by an auxiliary battery current controlled by the regulator. The regulator consists of a cylindrical glass bulb, filled with mercury, with a capillary stem above, into which the mercury expands on heating, thereby making contact with an inserted wire. The bulb has a vertical side-arm fitted with a mercury-tight cork piston, which can be raised or lowered so as to adjust the regulator to any desired temperature.

An Automatic Temperature Regulator. By Charles T. Knipp. *Phys. Rev.*, **12**, 47–49.—The motion of two pivoted copper-iron thermostats, after being multiplied by a system of levers, causes a make or break between platinum terminals in an electric circuit containing a relay, which opens or closes the main circuit which heats the bath. Temperatures from 20°–380° can be kept constant by it within 0.5°.

Note on Bunsen's Ice Calorimeter. By J. W. Mellor. *J. Phys. Chem.*, **4**, 135–136.—A description and diagram are given of a simple device for removing the dissolved air while filling the outer chamber of the ice calorimeter.

Note on Some Modified Forms of Physico-Chemical Measuring Apparatus. By Allerton S. Cushman. *J. Am. Chem. Soc.*, **23**, 482–485.—The Arrhenius resistance cell is modified by holding the glass tubes carrying the electrodes in place by means of brass set-screws tipped with ebonite which enter horizontally through the edge of the (heavy) ebonite cover. While the electrodes are thereby held very firmly in place, they can be readily adjusted at any desired distance. The author modifies the Ostwald burette-calibrator by substituting a graduated scale for the single 2 cc. mark on the upper stem; and draws off always just 2 cc., read on the burette, and notes the reading on the pipette.

On the Velocity of Chemical Reactions. By William Duane. *Am. J. Sci.*, **161**, 349–356.—Two forms of apparatus are described for measuring the rate of chemical reactions. In one of these a

Digitized by Google

beam of light focused by a lens is passed through a prismatic tube divided diagonally into two wedge-shaped compartments; one contains the reacting mixture, and the other, in order to reduce the dispersion, is filled with the same solution which has already undergone the reaction. Owing to the change in index of refraction the beam is deflected from its original position as the reaction progresses, and its position is continuously photographed upon a plate placed at the focus and moved by clock-work. No provision is made for keeping the temperature constant. In the second form of apparatus the reacting mixture is placed in a spiral glass tube, and its change of volume is measured by the displacement of a mercury thread in a capillary tube attached to the spiral. The velocity-constants obtained for the sugar inversion with both forms of apparatus are very unsatisfactory.

An Efficient Boyle's-Law Apparatus. By W. J. Humphreys. *Phys. Rev.*, 10, 123–125. **Apparatus for Demonstrating Boyle's Law.** By F. J. Rogers. *Phys. Rev.*, 11, 112–114. **The Verification of Boyle's Law.** By N. H. Williams. *Phys. Rev.*, 11, 255–256. **An Apparatus for the Determination of the Coefficient of Expansion of Air at Constant Pressure.** By C. F. Adams. *Phys. Rev.*, 10, 178–179.—These four articles describe simple forms of apparatus which are intended for the laboratory instruction of students.

ORGANIC CHEMISTRY.

J. F. Norris, Reviewer.

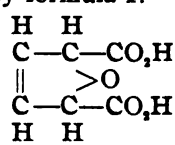
On Dehydromucic Acid. By Henry B. Hill. *Am. Chem. J.*, 25, 439–445.—The author gives an outline of the results of the work described in two articles which follow, and are here reviewed below.

On Dehydromucic Acid and Certain of Its Derivatives. By Isaac K. Phelps and William J. Hale. *Am. Chem. J.*, 25, 445–463.—The methods of preparation of dehydromucic acid were carefully studied, and, as a result, a modification of the best method is proposed, which gives very satisfactory results. The largest yield of the acid was obtained when acid potassium saccharate was boiled for sixteen hours with hydrobromic acid of the specific gravity 1.565. In this way 40 grams of the salt gave 13.85 grams dehydromucic acid. An attempt was made to prepare the acid by the method of Schmidt and Cobenzl, who state that the potassium salt of the acid could be made by the dehydration of potassium mucate at a high temperature, in an atmosphere of hydrogen. The salt prepared in this way proved not to be the compound expected. The method and properties of the following-named substances are given fully: Dehydromucic acid, and its barium and calcium salts, the mono-

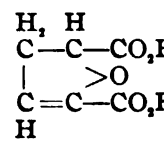
Digitized by Google

methyl (m. p. 201°–202°) and monoethyl (m. p. 148°–149°) esters, the amide (m. p. 280°–281°), dianilide (m. p. 227°–228°) and the anhydride of the acid. When the dehydrated acid was heated with acetic anhydride, it was converted into dehydromucic-diacetic anhydride, $C_{10}H_8O_7$, which decomposed rapidly at 150°. Potassium dehydromucate, in the presence of an excess of potassium carbonate, is converted by bromine into dibromfurfuran tetrabromide (m. p. 112°). Iodine also reacts with the salt and at 100° diiodofurfuran (m. p. 47°) is formed. $\alpha\alpha'$-Dibenzoylfurfuran (m. p. 107°) was readily prepared by the action of aluminum chloride on a solution of dehydromucyl chloride in benzene. No well-defined products could be obtained by the action of reducing agents on the ketone. Aqueous bromine at 140° converted it into dibrommaleic and the three brombenzoic acids. The ketone was converted into $\alpha\alpha'$-dibenzoylfurfuran diphenylhydrazone (m. p. 155°–156°). The dioxime of the ketone was separated into two isomers by making use of the hydrolytic dissociation of the sodium salts of the oxime. The α-dioxime melts at 213°–214° and the β-variety at 243°–245°.

On the Reduction of Dehydromucic Acid. By Henry B. Hill and Alvin S. Wheeler. *Am. Chem. J.*, **25**, 463–485. —The authors have studied carefully the reduction of dehydromucic acid, and have cleared up this reaction which has given different results in the hands of different observers. When the acid is reduced at 0° by means of sodium amalgam, and care is taken to prevent the accumulation of sodium hydroxide, the product is almost wholly α-dihydrofurfuran-$\alpha\alpha'$-dicarboxylic acid. When the reduction takes place at ordinary temperatures, however, the chief product is the so-called β-acid. This acid is converted by boiling with sodium hydroxide into a new compound which is called the γ-acid. As a result of a study of the reactions and properties of these acids, the conclusion is drawn that the α-acid—the first product of the reduction—has the structure represented by formula I.



I.



II.

This configuration contains two asymmetric carbon atoms and should give an inactive (cis) form and two optically active (cis-trans) forms. The α-acid is the cis form. The β-acid has the same structure but is a combination of the two active cis-trans forms. The γ-acid has the structure of formula II, and is made up of the two possible active forms. By the prolonged action of sodium amalgam the γ-acid is converted into the corresponding

Digitized by Google

tetrahydrofurfuran dicarboxylic acid, while the α- and β-acids can not be further reduced. These facts are evidence of the correctness of the formulae proposed, for it has been shown by v. Baeyer that in the case of analogous acids, hydrogen is added, under these conditions, to doubly linked carbon atoms only when the double bond is adjacent to a carboxyl group. The three acids readily add bromine. The α- and β-dibromides are decomposed in alkaline solution in the cold with the elimination of carbon dioxide, and the almost quantitative formation of pyromucic acid. Under the same conditions the γ-acid loses carbon dioxide, but no pyromucic acid is formed. Preliminary experiments have shown that the β-acid gives two cinchonine salts of different solubilities, and that the acids prepared from these salts are optically active with opposite rotations. The γ-acid has also been resolved into optically active isomers. In addition to a full description of the compounds mentioned above, the barium, silver, lead, and calcium salts of the α- and β-acids are adequately described. Chlorine does not give with the acids addition-products as bromine does. In aqueous solution chlorine converts the α- and β-acids into the corresponding chlorhydroxytetrahydrofurfuran-αα'-dicarboxylic acids.

The Constitution of the Oxyazo Compounds. By William McPherson and Herbert C. Gore. *Am. Chem. J.*, **25**, 484–496.—In continuing the study of the structure of oxyazo compounds, the authors have investigated the action of unsymmetrical benzoyl-α-naphthylhydrazine on certain paraquinones. The results are in accord with an earlier investigation (*Am. Chem. J.*, **22**, 364), and show that the acyl derivatives of the *p*-oxyazo compounds, formed by the interaction of α-naphthyldiazonium chloride on phenol, *o*-cresol, and thymol, respectively, contain the acyl group joined to oxygen, and, hence, are true oxyazo compounds. α-Benzoyl-α-naphthylhydrazine (m. p. 98°) was prepared from β-acetylnaphthylhydrazine by first converting the latter substance into α-benzoyl-β-acetyl-α-naphthylhydrazine (m. p. 184°) by heating with benzoyl chloride and then eliminating the acetyl group by boiling with dilute sulphuric acid. With benzoquinone this hydrazine derivative yields quinonebenzoyl-α-naphthylhydrazine (m. p. 113.5°), which is converted by saponification into α-naphthaleneazophenol (m. p. 136°). This latter compound was also prepared by the action of α-naphthyldiazonium chloride on phenol, and was converted into a benzoyl derivative (m. p. 120°). By the action of benzoylnaphthylhydrazine on toluquinone and thymol analogous compounds were prepared, which were studied in the way used with the benzoquinone derivative.

Action of Phenols on Ethylic Oxalate. By J. Bishop Tingle and Leo O'Byrne. *Am. Chem. J.*, **25**, 496–501.—The authors

Digitized by Google

find that certain phenols form condensation-products with ethyl oxalate. The compounds, which were not analyzed, will be studied further.

Certain Derivatives of Metadibromdinitrobenzene. By C. Loring Jackson and W. P. Cohoe. *Am. Chem. J.*, **26**, 1–9.—The structure of the dibromdinitrobenzene melting at 117.4° was shown to be $C_6H_2Br_2{}^1,{}^3(NO_2)_2{}^4,{}^6$, by heating it with aniline, when it was converted into a dianilidodinitrobenzene of known structure. In the cold but one bromine atom was removed and bromanilidodinitrobenzene (m. p. 157°) was formed. This substance occurs in a yellow and a red modification which seem to differ in crystalline form. The two former can be converted one into the other. Sodium phenylate converted the dibromdinitrobenzene into diphenoxydinitrobenzene (m. p. 129°) which, in turn, was converted by sodium malonic ester into a compound in which a phenoxy group was replaced by the malonic ester group. The dibromdinitrobenzene, when reduced with zinc dust and acetic acid, gave a dibrom-*m*-phenylenediamine identical with the compound obtained by treating *m*-phenylene diacetamide with bromine. It follows that the base has the structure:

$$C_6H_2Br_2{}^1,{}^3(NH_2)_2{}^4,{}^6.$$

On Certain Derivatives of Orthobenzoquinone. By C. Loring Jackson and Waldemar Koch. *Am. Chem. J.*, **26**, 10–46.—Previous attempts to prepare *o*-benzoquinone have been unsuccessful, because the compound is so unstable that it cannot exist in the presence of oxidizing agents. The authors have succeeded, however, in obtaining the substance in solution by preparing it by the treatment of the lead salt of pyrocatechin with iodine in chloroform solution. The preparation of quinone from hydroquinone in an analogous way showed that this new method was a good one. From the garnet-red solution the orthoquinone could not be isolated, but its presence was shown by the reactions of the dissolved substance with a number of reagents. With hydrochloric acid, pyrocatechin and its monochlor derivative were formed. Reducing agents produced pyrocatechin. Bromine formed tetrabrompyrocatechin. With benzenesulphinic acid there resulted an *o*-dioxydiphenylsulphone (m. p. 153°), isomeric with the compound prepared by Hinsberg and Himmelschein by oxidizing pyrocatechin in the presence of benzenesulphinic acid. With aniline the chloroform solution of the *o*-quinone gave a dianilidoquinoneanil, $C_6H_2(C_6H_5NH)_2O(C_6H_5N)$, which melted at 203° and proved to be identical with the substance prepared from *p*-quinone, aniline, and acetic acid. The compound has, therefore, the substituting groups in the para position. The probable cause of the reaction by which the compound is formed from an ortho compound is given, and reference

Digitized by Google

is made to analogous transformations. The solution of the *o*-quinone, when treated with *o*-phenylenediamine, did not yield a phenazine, but the reaction seemed to consist simply in the oxidation of the diamine. On standing, the solution of the *o*-quinone deposited a black amorphous substance, which proved to be identical with the substances prepared in an earlier investigation by the action of electrolytic oxygen on pyrocatechin. From a study of this compound the conclusion is drawn that it has the structure represented by the formula $O_2(HO)C_6H_2—C_6H_2(OH)_2$, in which two of the hydroxyl groups are in the ortho position to each other. That the compound is a diphenyl derivative and not a pyrocatechin ether, was shown by the action of reducing agents, which did not convert it into pyrocatechin—a reaction which would have taken place if the two phenyl groups had been united by oxygen atoms. The presence of three hydroxyl groups was shown by making a tribenzoyl derivative, and the ketonic oxygen was indicated by the formation of substances containing nitrogen when the original compound or its benzoic ester were treated with phenylhydrazine. All the substances were amorphous and infusible. Tetrabrom-*o*-quinone was studied carefully. When treated with tetrabrompyrocatechin the following reaction took place:

$$C_6Br_4(OH)_2 + C_6Br_4O_2 = C_{12}Br_6O_4 + 2HBr.$$

The resulting compound, which was bright red in color, was shown to have the structure $C_6Br_4 : O_2 : C_6Br_2O_2$ (hexabrom-*o*-quinopyrocatechin ether) by subjecting it to reduction when, by an indirect method, the substance was converted quantitatively into pyrocatechin. This result excluded the possibility that the compound was a diphenyl derivative. In the reduction of this quinone ether, an intermediate brown product was formed which was shown to be the corresponding pyrocatechin of the formula $C_6Br_4 : O_2 : C_6Br_2(OH)_2$. A reaction similar to the above took place between tribromresorcin and tetrabrom-*o*-quinone, and a compound (m. p. 217°) of the formula $(C_6HBr_2OHO)_2C_6Br_2O_2$ was the result. When tetrabrom-*o*-quinone is evaporated to dryness with glacial acetic acid, the greater part of the quinone is converted into a white crystalline substance, melting at 230°, the analysis of which led to the formula $C_{14}H_2Br_6O_6$ or $C_{14}Br_8O_6$. The formula containing hydrogen is adopted provisionally by the authors. The properties of the new compounds prepared in the investigation are described in detail.

On the Action of Sodic Sulphite on Tribromdinitrobenzol and Tribromtrinitrobenzol. By C. Loring Jackson and Richard B. Earle. *Am. Chem. J.*, **26**, 46–55.—When an alcoholic solution of tribromdinitrobenzene ($Br_3$1,3,5$(NO_2)_2$2,4) is boiled with sodium sulphite the bromine atom between the two nitro groups is replaced by hydrogen. Tribromtrinitrobenzene

Digitized by Google

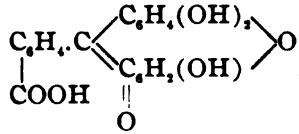
undergoes a similar reduction and a new dibromtrinitrobenzene ($Br_2$1,3(NO_2)$_3$2,4,6) is formed, which melts at 135°. In the hope of finding an easier method of making this compound, the action of a mixture of nitric and sulphuric acids on dibromdinitrobenzene was studied. The desired compound was obtained, but mixed, however, with a large proportion of a tribromdinitrobenzene, which proved to be a new compound having the structure ($Br_3$1,2,3(NO_2)$_2$4,6). The dibromtrinitrobenzene gave styphnic diethyl ether when treated with sodium ethylate. With the same reagent the tribromdinitrobenzene gave a new bromdinitroresorcin monoethyl ether, which melted at 78°.

Symmetrical Tri-iodbenzol. By C. Loring Jackson and G. E. Behr. *Am. Chem. J.*, **26**, 55–61.—Symmetrical tri-iodbenzene (m. p. 181) was prepared from tri-iodoaniline by means of the diazo reaction. The substance proved to be identical with the compound which was prepared by Istrati by heating together benzene, iodine, and sulphuric acid. The structure of the compound was proved by converting it into a dinitro derivative, which with aniline yielded symmetrical trianilido-dinitrobenzene.

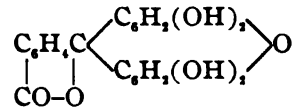
The Constitution of Gallein and Coerulein. By W. R. Orndorff and C. E. Brewer. *Am. Chem. J.*, **26**, 97–159.—The authors have reviewed with great care the work on gallein and coerulein, and have discovered facts that lead to new formulas for these substances. The composition of the acetyl derivatives of these compounds has not been firmly established heretofore, as analyses for carbon and hydrogen do not serve to settle this point. Definite conclusions, which in some cases are different from those put forward by earlier investigation, have been obtained by saponifying the esters and determining the amount of acetic acid produced. The melting-points of the carefully purified compounds do not in all cases agree with those reported by others. A number of new compounds have been prepared, which proved of value in determining the structure of the compounds under investigation. The work has established a number of important facts. The only product formed by the reduction of gallein by zinc dust in acid or alkaline solution is gallin. Gallein forms monoesters, showing that it contains one carboxyl group, and unites with three molecules of phenyl isocyanate, which proves that it contains three phenolic hydroxyl groups. Two classes of tetra-alkyl ethers, colored and colorless, are derivable from gallein, indicating that it reacts in tautomeric modifications. The compound forms a colorless tetracetate, trialkyl derivatives which resemble phenolphthalein, and a colorless trimethyl monacetate. The preparation of a pentamethyl ether, a tetracetate, and a silver salt of the tetracetate of gallin furnished evidence of the structure of gallin. Coerulein forms a triacetate, a pentacetate,

Digitized by Google

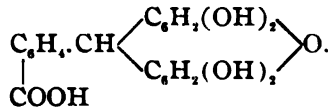
two monomethyl ethers, and a methyl ether insoluble in alkalies. From a consideration of the facts enumerated above the conclusion is drawn that the structure of gallein is represented by the formula



The fact that gallein and a number of its esters are colored is probably the result of the quinoid structure. The colorless derivatives of gallein are supposed to be derivatives of the tautomeric form



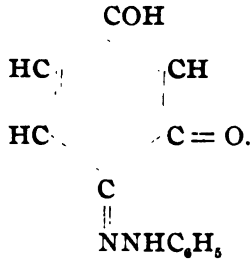
The structure which is assigned to gallin, on account of its relation to gallein, is the following:



Coerulein is the phthalidein of gallein. The compounds which are described are named below, together with their melting-points. The following derivatives of gallein: tetracetate 241°, tetrabenzoate 226°, methyl ester which did not melt when heated to 280°, ethyl ester, triphenyl carbamate, trimethyl ether 229°, tetramethyl ether which existed in two forms, colorless 195° and colored 199°, tetraethyl ether, colorless 144° and colored 155°, triethyl ether, basic lead salt, and the acetate of the trimethyl ether 197°. The tetracetate (m. p. 216°) and its silver salt and the pentamethyl ether (m. p. 127°) of gallein are described. Coerulein triacetate, two methyl ethers, and a monoethyl ether were also studied.

On the Two Modifications of Benzene-4-azoresorcin and the Constitution of the Oxyazo Compounds. By W. R. Orndorff and E. D. Thebaud. *Am. Chem. J.*, **26**, 159–166.—On account of the fact that the diacetyl derivative of benzene-4-azoresorcin yields acetanilide and amidoresorcin when reduced with zinc dust and acetic acid, the conclusion has been drawn that the compound is a hydrazone quinone, and that it has the formula

Digitized by Google



The fact that benzene-4-azoresorcin exists in two modifications can be explained if the above formula is accepted, for the double bond between the carbon and nitrogen atoms gives a chance for stereoisomerism. In order to test this view the authors have prepared a number of derivatives of benzene-*α*-azoresorcin, and have endeavored to separate each compound into isomers. The diacetyl derivative, prepared from either isomer, melts at 104°. When the compound was crystallized from·35 per cent. alcohol a substance was obtained which melted at 106° and had a reddish yellow color, whereas the product crystallized from ordinary alcohol melted at 104° and had a pure yellow color. The monoethyl ether of benzene-4-azoresorcin crystallizes from alcohol in short, brownish red crystals, which melt at 87°. When the product was recrystallized from dilute alcohol, it gave long, reddish yellow crystals, which melted at 88°. The diacetyl derivative of benzene-4-azoresorcin reacted with phenylhydrazine, forming a bis-phenylhydrazone (m. p. 163°). This fact is strong evidence of the correctness of the structure which has been assigned to the compound. This diacetyl compound was saponified and the corresponding bisphenylhydrazone (m. p. 160°) was isolated. In an attempt to prepare the orthomethyl ether of benzene-4-azoresorcin, a compound (m. p. 189°–190°) of the structure $C_6H_2(OH)1,(N_2HC_6H_5)_2,2,4(OCH_3)_3$ was prepared.

On the Oxygen Ethers of the Ureas: Methyl- and Ethylisourea. By Ralph H. McKee. *Am. Chem. J.*, **26**, 209–265. —On account of the fact that isocarbanilides,

$$C_6H_5NH.C(:NC_6H_5)OR,$$

in some of their important reactions, *e. g.* saponification and formations of amides, exhibit an entirely different behavior from that of other known ethers of analogous structure, such as acid esters RC(:O)OR and imido esters RC(:NH)OR, an exhaustive investigation of isoureas of simpler structure than the isocarbanilides was carried out. The striking difference in reaction of compounds of the same class might be produced by the difference in basicity of the compounds. This hypothesis would explain the difference in the hydrolysis of the hydrochlorides of

Digitized by Google

the weak bases of the imidoether type, and of the stronger bases of the urea ether type. Another explanation which was suggested, *viz.*, that the differences are produced by stereochemical interference, which varies with groups of different size and weight, was subjected to investigation. The experimental results showed clearly that this view was not correct. As a step toward explaining the differences noted above, a number of ethers of the types $C_6H_5NH.C(:NH)OR$, $C_6H_5NCH_3.C(:NH)OR$, and $NH_2C(;NH)OR$ were prepared and investigated. The methods for preparing these new classes of ethers have been so developed that the compounds can be prepared as readily as any imidoether. The ethers were readily benzoylated and condensed with phenyl isocyanate. In this way isourea ethers with negative groups were obtained. Every isourea ether obtained gave an alkyl chloride and a urea on heating with dilute hydrochloric acid. The study of the behavior of the new urea ethers towards amines was not completed, but in the case of the monophenylated isoureas it was shown that in no case was the reaction with aniline a smooth one, with the formation of an amide. The simple isourea ethers show, therefore, the same characteristic lack of power to form normal saponification-products and amides as do the isocarbanilides. Reference must be made to the original paper for an account of the large number of compounds which are carefully described.

On Acetyl and Benzoylimidodithiocarbonic Esters. By Henry L. Wheeler and Treat B. Johnson. *Am. Chem. J.*, **26**, 185–206.—The possibility of stereoisomerism in acylimidodithiocarbonic esters is suggested by the presence of a double bond in the compounds between a carbon and a nitrogen atom. To determine whether such isomerism exists, methyl ethyl benzoylimidodithiocarbonate,

$$C_6H_5CO.N=C\begin{matrix}SC_2H_5\\SCH_3\end{matrix},$$

was prepared in two ways which would produce isomers if such forms exist. The compounds used had the formulas

$$C_6H_5.CO.N=C\begin{matrix}SNa\\SCH_3\end{matrix} \quad \text{and}$$

$$C_6H_5—CO.N=C\begin{matrix}S.C_2H_5\\SNa\end{matrix}.$$

The first was treated with ethyl iodide and the second with methyl iodide. The resulting product proved to be an oil in each case, which boiled at 224° at 20 mm. pressure. The question was not settled by these experiments, as even if isomers had been

Digitized by Google

formed, the more unstable one would probably have been converted into the staple form when heated to such a high temperature. A detailed account is given of a number of experiments, which had as their aim the preparation of crystalline reaction-products. In some cases the acyldithiocarbonates were oils, in others the two methods of preparation could not be used. When the radicals introduced were the benzyl and metaxylyl groups the results were satisfactory. Crystalline products were obtained by the two methods of preparation. These compounds proved to be identical and, accordingly, it is evident that stereoisomeric acylimidodithiocarbonic esters do not result by the methods employed. When these esters are treated with amines a mercaptan is evolved, and acylpseudothioureas of a new type are formed. The behavior of the esters with hydrochloric acid and with hydrogen sulphide was also investigated. A number of new compounds prepared in the course of the work are described.

Camphoric Acid: Racemic Campholytic Acid and Racemic Dihydrohydroxycampholytic Acid. By William A. Noyes and W. M. Blanchard. *Am. Chem. J.*, **26**, 281–292.—The authors have shown that inactive campholytic acid (m. p. 31°, b. p. 127°–128° at 14 mm.) is the racemic form corresponding to α-campholytic acid. The acid required for the investigation was prepared by allowing β-campholytic acid to stand in contact with fuming hydrobromic acid for several days, and by decomposing the resulting hydrobromide with caustic soda. This hydrobromide of β-campholytic acid gradually passes over, almost completely, into the hydrobromide of the α-acid. This transformation is explained readily if the formula for campholytic put forward by the authors in an earlier paper (*Am. Chem. J.*, **24**, 286) is accepted. When the hydrobromide of the racemic α-campholytic acid is treated with caustic soda there is formed, in addition to the regeneration of campholytic acid, a small amount of the lactone first discovered by Kerschbaum and Tigges and a small, but relatively larger, amount of a new hydroxy acid, which was shown to be the racemic form of dihydrohydroxycampholytic acid (m. p. 176°), by separating it into its optically active components (m. p. 132°) and identifying the right-handed form with that acid. As this new hydroxy acid corresponds in configuration to the hydrobromide of the racemic α-campholytic acid, and as that hydrobromide is always formed by the addition of hydrobromic acid to the racemic acid, it follows that addition produces but one configuration, whereas if campholytic acid has the structure proposed by Bredt two configurations would be possible. The formula proposed by the authors is in accord with the above facts. The formation of a lactone on treating dihydroaminocampholytic acid with nitrous acid has been taken as evidence that in this acid the amino group is in the γ-position with regard to the carboxyl.

Digitized by Google

This conclusion is now doubtful, as it has been shown that camphoric, dihydroaminocampholytic, dihydrohydroxycampholytic, and bromdihydrocampholytic acids are all active, whereas the lactone prepared from active dihydroaminocampholytic acid is inactive. This lactone has also been prepared by warming the nitroso derivative of the anhydride of dihydroaminocampholytic with sodium hydroxide. The authors show that the chief products of this reaction are active α-campholytic acid and active dihydrohydroxycampholytic acid, which, accordingly, correspond in configuration to the original amino acid. By the reduction of the hydroiodide of the racemic α-campholytic acid a new dihydro-α-campholytic acid (b. p. 245°–247°) was prepared. This acid was converted into the α-bromine derivative (m. p. 148°) which yielded a new campholytic acid which has the double union in the position Δ^3. This acid melts at 90°–91° and gives an amide which melts at 90°.

Acetanilide. By CHARLES W. GORR. *Pharm. Rev.*, 18, 402–408.—Physical and chemical tests for acetanilide are described in some detail.

Note: Zinc-Copper Couple for Preparing Zinc Ethyl. By W. A. NOYES. *Am. Chem. J.*, 24, 467.—Attention is called to the fact that zinc filings for the preparation of the zinc-copper couple may be replaced by a kind of granulated zinc which is on the market.

On Tritolylchlormethane. By M. GOMBERG AND O. W. VOEDISCH. *J. Am. Chem. Soc.*, 23, 177–178.—Tritolylchlormethane was prepared by the action of carbon tetrachloride on toluene in the presence of aluminum chloride. The compound was converted into the corresponding ethoxyl derivative (m. p. 105°) when it was heated with alcohol. By the action of water on the chloride the corresponding carbinol was formed.

Note: The Nature of the Oxyazo Compounds. By WILLIAM MCPHERSON. *Am. Chem. J.*, 25, 80.—In a recent paper the author stated that free paraoxyazo compounds do not react with phenylhydrazine. This statement the author finds to be incorrect. A reaction takes place slowly at 100° with the formation of a white crystalline substance, which is now being studied.

The Detection of Methyl Alcohol in the Presence of Ethyl Alcohol. By ALBERT B. PRESCOTT. *Pharm. Arch.*, 4, 86–90.—The method described is briefly as follows: The diluted spirit is treated with a hot oxidized copper spiral a number of times. Hydrogen peroxide is added to destroy the acetic aldehyde, and then sodium thiosulphate to decompose the excess of the peroxide. The solution so obtained is tested for formic aldehyde by means of phloroglucinic and sodium hydroxide.

Digitized by Google

The Revival of Organic Chemistry. By H. N. Stokes. *Science*, **12**, 537.—This paper was delivered as the annual address of the president of the Chemical Society of Washington. The author reviews briefly the history of stereochemistry, tautomerism, catalysis, and other recent theories of organic chemistry. It is clearly shown that organic chemistry offers as richly as ever before opportunities for important work. The advance in this part of the science is to come through the applications of the methods of study which have advanced empirical inorganic chemistry to the science of modern general chemistry. The study of catalytic action in the realm of physiological phenomena will without doubt lead to discoveries of great importance to the welfare of man. The paper is a strong answer to those who are of the opinion that organic chemistry no longer offers opportunity for work of scientific importance.

Camphoroxalic Acid Derivatives. By J. Bishop Tingle. *J. Am. Chem. Soc.*, **23**, 363–392.—The author gives a summary of his work on camphoroxalic acid, which has been carried out at intervals during the last twelve years, and describes new experiments on the action of ammonia and certain aliphatic amines on camphoroxalic acid and its ethyl ester.

Synthesis of Derivatives of Dimethylcyclopentanone, β,β-Dimethyladipic Acid, and α,β,β-Trimethyladipic Acid. By W. A. Noyes. *J. Am. Chem. Soc.*, **23**, 392–402.—A detailed account of the methods of preparation and properties of the substances mentioned in the title are given. The substances are of importance as they are related to 2.33-trimethylcyclopentanone, a ketone which the author has recently synthesized and shown to be identical with a ketone previously obtained from camphoric acid by a series of reactions which can be easily followed.

On Some Addition-Reactions of Thio Acids. By Henry L. Wheeler. *J. Am. Chem. Soc.*, **23**, 443–450.—The methods of preparation, properties, and reactions of the addition-products formed from thiobenzoic acid and certain amidines, amidoesters, hydrazones, ureas, and amines are described.

On Trivalent Carbon. By M. Gomberg. *J. Am. Chem. Soc.*, **23**, 496–502.—The author calls attention to some errors in his previous work, and describes addition-products of the unsaturated hydrocarbon formed by the action of zinc on triphenylchlormethane, with ether and with ethyl acetate.

Preparation of 2,5-Dimethylbenzaldehyde; The Establishment of Its Constitution and Preparation of Some of the Derivatives. By Everhart P. Harding and Lillian Cohen. *J. Am. Chem. Soc.*, **23**, 594–606.—2,5-Dimethylbenzaldehyde was prepared by Gattermann's method from *p*-xylene.

Digitized by Google

The preparation was of interest as the aldehyde group was introduced into a position ortho to a methyl group. A number of derivatives of the new compound were prepared by the usual methods.

The Synthesis of Alkyl Ketodihydroquinazolines from Anthranilic Acid. By AUGUST HENRY GOTTHELF. *J. Am. Chem. Soc.*, 23, 611–632.—The reaction by which ketodihydroquinazolines are prepared by the action of nitriles on anthranilic acid has been studied carefully. The conditions under which the best yield of quinazoline is obtained have been established, and a number of new substances have been prepared. The influence of acids and their anhydrides on the reaction has been determined.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

A Method for the Determination of the Available Organic Nitrogen in Commercial Fertilizers. By JOHN PHILLIPS STREET. *J. Am. Chem. Soc.*, 23, 330–338.—The author regards the results obtained by existing methods as of doubtful value as a measure of the availability of the nitrogen present in fertilizing materials. A considerable number of experiments made by him seem to indicate that the most reliable figures are obtained by digesting the fertilizers with a 1.6 per cent. solution of potassium permanganate, on the steam-bath, and determining the total nitrogen in the residue (after washing with water) by the Kjeldahl method.

Method for Preparing Strictly Tenth-Normal, Fifth-Normal, Etc., Hydrochloric or Nitric Acid. By RICHARD K. MEADE. *J. Am. Chem. Soc.*, 23, 343–347.—An aqueous solution of copper sulphate, in known quantity, is subjected to the action of the electric current for the removal of the copper, the resulting solution of sulphuric acid is treated with barium chloride or nitrate, the precipitated sulphate is removed by filtration, and the solution made up to the required volume.

On the Separation of Tungstic and Silicic Acids. By H. L. WELLS AND F. J. METZGER. *J. Am. Chem. Soc.*, 23, 356–358.—The authors are unable to confirm the statement of Herting (*Ztschr. angew. Chem.*, 1901, 165) that on the ignition of silicic and tungstic acids a volatile silico-tungstic acid is formed. They were able to effect an accurate separation by treatment of the mixture with hydrofluoric acid, and only detected a loss when the temperature of the blast-lamp was employed for ignition, at which temperature tungstic acid is volatilized.

Digitized by Google

A New Indicator for Use in Determining Total Acidity of Wines. By E. G. RUNYAN. *J. Am. Chem. Soc.*, **23**, 402–405.—The author recommends a mixture of corallin (rosolic acid) and malachite green. The mixture shows a purple color with alkalies and a green with acids.

The Estimation of Carbonic Acid in Water. By JOSEPH W. ELLMS AND JAY C. BENEKER. *J. Am. Chem. Soc.*, **23**, 405–431.—The paper presents the results of comparative experiments made with the Pettenkofer, Trillich, and Lunge-Trillich methods. The authors conclude that "for ease and rapidity of manipulation, for avoidance of difficulties arising from the presence of magnesium salts, and for its greater accuracy, the Lunge-Trillich, or Seylor method, is to be preferred to either of the other two volumetric methods."

The Indirect Weighing of Quantitative Precipitates. A Rapid and Accurate Method for Determining the Weight of a Precipitate without Separating It from the Liquid in Which It Was Precipitated. By R. W. THATCHER. *J. Am. Chem. Soc.*, **23**, 644–668.—The following formula is employed: $x = \frac{d(a - bd')}{d - d'}$, in which x = the weight of the precipitate, d and d' the densities of precipitate and liquid respectively, and a the total weight and b the total volume of the liquid and precipitate together. The author has applied the procedure to the determination of chlorine as silver chloride, of sulphur as barium sulphate, of calcium as calcium oxalate, of phosphoric acid as phosphomolybdate, and of reduced cuprous oxide. He considers the procedures more rapid and accurate than the usual gravimetric methods. The original article contains many interesting details.

The Electrolytic Determination of Molybdenum. By LILY GAVIT KOLLOCK AND EDGAR F. SMITH *J. Am. Chem. Soc.*, **23**, 669–671.—Molybdenum is precipitated electrolytically from solutions acidified with sulphuric or acetic acids, as a black, adherent coating of hydrated sesquioxide. This cannot safely be weighed, but may be dissolved in nitric acid and ignited and weighed as molybdic acid. Analyses of molybdenite may be hastened by the application of this procedure to the aqueous solution of the fusion with sodium carbonate and nitrate. In this case acetic acid must be used if the sulphur is to be determined.

The Determination of Sulphur in Iron and Steel. By WILLIAM A. NOYES AND L. LESLIE HELMER. *J. Am. Chem. Soc.*, **23**, 675–679.—The authors find that the best results are obtained by solution of the iron or steel in bromine and water, or in dilute nitric acid and potassium bromide, with the addition of potassium

Digitized by Google

chlorate. The sulphur in the residue (if any) is determined by fusion with sodium carbonate and potassium nitrate. The sulphur in the original solution is precipitated after the removal of the iron by ammonia.

F. J. MOORE, REVIEWER.

Estimation of Calcium, Strontium, and Barium, as the Oxalates. BY C. A. PETERS. *Am. J. Sci.*, **162**, 216–224.—The authors sum up the results of their work as follows: "In the estimation of calcium by titration of the oxalate with permanganate, accurate results may be obtained when hydrochloric acid (with a manganous salt) is used as the solvent. Strontium salts may be precipitated by ammonium oxalate with practical completeness in a solution containing one-fifth its volume of 85 per cent. alcohol, and with approximate completeness from water solutions at a dilution not exceeding 250 cc. Furthermore, strontium oxalate may be titrated by permanganate with accuracy when either sulphuric or hydrochloric acid (with a manganous salt) is used to liberate the oxalic acid. Barium salts may be precipitated with practical completeness by ammonium oxalate in a solution containing one-third its volume of alcohol (85 per cent.) and the barium oxalate thus obtained may be dissolved in hydrochloric acid and titrated by permanganate after the addition of a manganous salt. Strontium and barium oxalates may be converted to the carbonates by ignition and weighed as such."

The Analysis of Slags and Cinders. BY CAVELIER H. JOUET. **Part II. Iron and Manganese Slags.** *School Mines Quart.*, **22**, 140–152.—This paper is one of a series upon the same subject. (See *this Rev.*, 7, 40.) It is not adapted for condensation.

Blast-Furnace and Steel Works Chemistry. BY J. M. CAMP. *Iron Trade Rev.*, **34**, (No. 12) 11.

The Quantitative Determination of Cadmium. BY EDMUND H. MILLER AND ROBERT W. PAGE. *School Mines Quart.*, **22**, 391–398.—The authors sum up the results of their work as follows: "(1) The electrolytic determination of cadmium is most accurate and satisfactory, provided a large excess of potassium cyanide and the presence of other salts are avoided. (2) The carbonate method is the most troublesome and the least accurate. (3) The cadmium ammonium phosphate contains one molecule of water of crystallization and can be dried without decomposition at 100°–103°. (4) Austin's method for cadmium is unsatisfactory. (5) Asbestos filters should be avoided on account of the solubility of the fibers in either ammonium phosphate or nitric acid. (6) Cadmium can be determined with great accuracy by precipitating in the cold, in a neutral solution,

Digitized by Google

by a large excess of acid ammonium phosphate, and allowing to stand over night; it can be weighed on balanced filters or ignited to pyrophosphate. If precipitated in a boiling solution, or on prolonged boiling, it is liable to change in composition and give low results. We recommend this method as preferable to the carbonate method in all respects, and while no more accurate than the electrolytic method, it has the practical advantage of requiring no extraordinary or expensive apparatus."

The Volumetric Determination of Zinc. By PERCY H. WALKER. *J. Am. Chem. Soc.*, 23, 468–470.—Stolba's method for the determination of magnesium may be successfully applied to the determination of zinc. The zinc is first precipitated as zinc ammonium phosphate. This is filtered off, and titrated with standard acid. The presence of considerable quantities of iron, calcium, and magnesium salts does not interfere with the accuracy of the results, but manganese must be previously separated.

The Oxidation of Nitrogen as a Source of Error in the Estimation of Hydrogen and Methane. By ALFRED H. WHITE. *J. Am. Chem. Soc.*, 23, 476–482.—The author sums up the results of his investigation as follows: "Oxides of nitrogen are always formed in explosion analysis in amount increasing with the violence of the explosion. The dilution recommended by Bunsen, when exploding in eudiometer tubes under reduced pressure, is not sufficient when working with the Hempel explosion-pipette. If the explosive ratio is kept between four and three, the error is negligible in the technical analysis of gases almost entirely hydrogen. The presence of small amounts of methane increases the error, and if large amounts of methane are present, the error may easily amount to a per cent. or more. The explosive ratio should be kept between four or three as in the case of hydrogen. The method of Dennis and Hopkins tends to give high results, and the errors may easily become of importance if care is not taken to avoid heating the spirals too hot and too long. Neither the explosion method nor any method involving active combustion can give strictly accurate results."

A Rapid Method for the Determination of Arsenious Oxide in Paris Green. By S. AVERY AND H. T. BEANS. *J. Am. Chem. Soc.*, 23, 485–486.—The sample is suspended in water, and dissolved by the addition of a little concentrated hydrochloric acid. The arsenic present is then determined volumetrically by oxidation with iodine in a solution of sodium bicarbonate. The copper is held in solution by means of a solution of sodium potassium tartrate. The authors find that the presence of copper does not interfere with the determination of the end-point. Results are a little higher than by other methods.

Digitized by Google

Modified Williams' Method for Manganese. By RANDOLPH BOLLING. *J. Am. Chem. Soc.*, **23**, 493–496.—The modifications introduced by the author are directed toward rendering the filtration of the precipitated manganese dioxide more rapid.

The Electrolytic Separation of Mercury from Copper. By ROSCOE SPARE AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **23**, 579–582. The authors defend their electrolytic method against the criticisms of Goecke and others. The results of several analyses are added.

Precipitation and Separation of Silver in the Electrolytic Way. By W. H. FULWEILER AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **23**, 582–585. Silver may be determined electrolytically in cyanide solutions containing three or four other metals, for example, copper, cadmium, and zinc. Records of analyses illustrating the necessary conditions of concentration, strength of current, and so forth, are presented in tabular form.

Notes on the Analysis of Explosives. By F. W. SMITH. *J. Am. Chem. Soc.*, **23**, 585–589.—Methods are described in detail for the determination of sulphur and nitroglycerine in dynamite, also some suggestions upon the standardization of Lunge's nitrometer.

The Electrolytic Method Applied to Uranium. By LILY GAVIT KOLLOCK AND EDGAR F. SMITH. *J. Am. Chem. Soc.*, **23**, 607–609.—This article consists almost entirely of tables containing the results of analyses showing how uranium can be successfully separated by electrolysis from iron, barium, calcium, magnesium, and zinc.

Sampling Pig Iron. By W. G. SCOTT. *Foundry*, **17**, 242–245.—Ten pigs are selected from each lot with reference to the relative properties of close, medium or open-grained. An equal amount of borings is taken from each pig and the whole intimately mixed. In taking the borings the ends of the pigs selected are broken off and holes drilled in the face of each in a circle about half-way between the centre and circumference of the pig. The latter part of the article is devoted to a discussion of the way in which various qualities of the pig iron should be mixed in order to secure castings suitable for different purposes.

PROXIMATE ANALYSIS.

A. G. WOODMAN, REVIEWER.

A Modification of the Sulphuric Acid Test for Formaldehyde in Milk. By A. GUSTAV LUEBERT. *J. Am. Chem. Soc.*, **23**, 682–683.—Five grams of coarsely powdered potassium sulphate are placed in a 100 cc. flask, 5 cc. of the milk distributed over it

Digitized by Google

by means of a pipette and 10 cc. of sulphuric acid (sp. gr. 1.84), carefully poured down the side of the flask. If formaldehyde is present the violet coloration of the potassium sulphate will take place in a few minutes. The test is said to be sensitive to a dilution of at least one part of formaldehyde in 250,000 parts of milk.

Household Tests for the Detection of Oleomargarine and Renovated Butter. By G. E. PATRICK. *U. S. Dept. Agr., Farmers' Bull.*, 131, 1–11.—Two tests, the boiling or "spoon" test and a modification of the Waterhouse test (*this Rev.*, 7, 119), are described which should enable any one, with the ordinary kitchen facilities, to distinguish in most cases between genuine butter, renovated butter, and oleomargarine.

Analyses of Miscellaneous Food Materials. By CHAS. D. WOODS AND L. H. MERRILL. *Me. Agr. Expt. Sta. Bull.*, 75, 89–112.

On the Qualitative Determination of the Organic Acids in the Fruit of Rhus Glabra, L. and of Rhus Canadensis, Marsh. By EDO CLAASSEN. *Pharm. Rev.*, 19, 345–347.—Experimental evidence is presented to show that it is practically impossible to extract from a liquid, containing a great deal of organic substances, the malic acid in the form of its neutral ammonium salt. A method is proposed which is fairly rapid and gives good results in the determination of the acids in fruits, leaves, etc.

The Extraction of Morphine with Immiscible Solvents. By W. A. PUCKNER. *J. Am. Chem. Soc.*, 23, 470–473.—Experiments were carried out to ascertain whether, in extracting morphine from solution by a mixture of chloroform and alcohol, the alkaloid might not be liberated by ammonium hydroxide instead of fixed alkali. The results show that ammonium hydroxide does combine with morphine to form a salt not readily taken up by alcohol-chloroform but that it does so to a much less extent than sodium hydroxide. A great excess of alkali should be avoided.

Opium Assay. By A. B. STEVENS. *Pharm. Archives*, 4, 81–86.—The author uses a modification of the lime method, making a correction for the amount of morphine lost during the assay. Detailed directions for the procedure are given.

Recent Progress in the Study of Vegetable Foods and Drugs. By HENRY KRAEMER. *Pharm. Rev.*, 19, 387–398.—This paper is a comprehensive résumé of the important work done during the past year on the properties and constituents of vegetable foods and drugs.

A New Alcohol Table. By A. B. LYONS. *Pharm. Archives*, 4, 101–106.

Digitized by Google

H. P. TALBOT, REVIEWER.

A Comparison of the Solubility of Acetylene and Ethylene. BY SAMUEL AUCHMUTY TUCKER AND HERBERT R. MOODY. *J. Am. Chem. Soc.*, **23**, 671–674.—The separation of these gases by means of ammoniacal cuprous chloride, alcohol or acetone was unsuccessful owing to the solubility of the ethylene in these reagents, while Nordhausen acid holds back acetylene as well as ethylene. An ammoniacal silver solution, however, absorbs acetylene and holds back but a trifling amount (about 0.2 cc. in 26 cc.) of the ethylene, admitting of a separation sufficiently exact for many purposes.

F. H. THORP, REVIEWER.

A New Method of Adulterating Wine. Note. *J. Franklin Inst.*, **152**, 178.—Red wines may be decolorized and made to resemble the more expensive white wines by treatment with boneblack and potassium permanganate. The chief interest in the item lies in the method proposed for the detection of this sophistication; 10 cc. of the wine are treated with 0.5 cc. of caustic soda solution, and then 1 cc. of hydrogen dioxide added, and the mixture is shaken. If the wine is doctored, the test assumes a mahogany-red color.

E. H. RICHARDS, REVIEWER.

Standard Method of Water Analysis. BY GEORGE W. FULLER. *Eng. Record*, **44**, 296–299.—This paper is a report made to the chemical and bacteriological section of the American Public Health Association by a committee. The work undertaken is indicated by the title and is an excellent example of what may be accomplished by cooperation.

The Estimation of Carbonic Acid in Water. BY JOSEPH W. ELLMS AND J. C. BENEKER. *J. Am. Chem. Soc.*, **23**, 405–431.—The paper gives detailed statements of experiments upon three methods of determining carbonic acid, resulting in a recommendation of that known as the Lunge-Trillich or Seyler method, in which the free carbonic acid is titrated with sodium carbonate with the help of phenolphthalein.

INDUSTRIAL CHEMISTRY.

F. H. THORP, REVIEWER.

The Chemistry of Deposits in Steam Boilers. BY W. E. RIDENOUR. *J. Franklin Inst.*, **152**, 113–118.—An analysis of Schuylkill river water is given, together with a calculation in which it appears that a thousand horse-power plant, evaporating 4 gals. per horse-power per hour, deposits 671 lbs. of sediment per month of twenty-six working days. The author divides boiler deposits into four classes: (1) the calcium sulphate scales;

Digitized by Google

(2) the calcium carbonate scales; (3) the silicate scales; and (4) the magnesia scales. The properties of these four scales are discussed briefly and analyses of typical scales in each class are given. The silicate scales contain calcium silicate, supposed to be formed during violent boiling under pressure, by reaction between free silicic acid and the calcium carbonate in the water. Analyses of a Pennsylvania water containing silica, and of the scale which formed from it are given, and it appears that the calcium carbonate present in the water, completely disappeared before the formation of the scale. No characteristic physical appearance could be attributed to the silicate scales. It is also shown that an opinion of the water supply should not be based on the analysis of a single sample of the scale, for this differed in the various parts of the boiler; a sample from near the feed-pipe contained mainly calcium carbonate, precipitated by the volatilization of the free carbonic acid, when the water first encounters the heat, while the scale from the bottom plates, the hottest part of the boiler, showed a large percentage of calcium sulphate.

The Portland Cement Industry in New York. By Edwin C. Eckel. *Eng. News*, **45**, 365–367. A summary of the early history of the industry is given, followed by descriptions of the material used at each of the several plants in the state and analyses of their products. The technology of Portland cement-making, as carried on in these plants, is discussed and it appears that there is considerable diversity in the methods employed. The rotary furnace, the ball mill, and the tube mill are meeting with constantly increasing favor.

The Purification of Acetylene Gas. By George W. Kuchler. *Eng. Rev.*, **9**, 21–22.—This is a popular article recommending the use of "puratylene" for the removal of hydrogen sulphide and phosphide from crude acetylene gas, generated from calcium carbide. It is claimed that the presence of phosphoretted hydrogen, especially, gives the gas a foul odor, leads to obstruction of the burners through deposition of carbon, and renders the gas self-inflammable. Puratylene is a special preparation of chloride of lime, which consists of porous lumps, thus admitting of intimate and thorough contact of the gas with the purifying agent. It also dries the gas.

Charcoal Production and Recovery of By-Products in Germany. By Frank H. Mason. *U. S. Consular Rep.*, **66**, 253–261.—This report gives a very good résumé of the method of distilling wood and of the properties and mode of separation of the several products.

Improvement in Welsbach Gaslights. By Frank H. Mason. *U. S. Consular Rep.*, **66**, 262–265.—In this report is described

Digitized by Google

the invention of R. Langhans for treating the thoria-ceria mantle with the silico-zirconate of soda, whereby the mantle is rendered stronger, the candle-power made more permanent, and the tendency to shrinkage is much reduced. The life of the improved mantles is set at from eighteen hundred to two thousand hours.

Electrolysis in Bleaching Textiles. By ERNEST L. HARRIS. *U. S. Consular Rep.*, **66**, 265–270.—The report consists of a description of the apparatus of Oettel, Haas, and Stahl for producing "chemic" or sodium hypochlorite liquor for bleaching. Illustrations of the apparatus are included.

Utilization of the Waste from the Use of White Metals. By JOSEPH RICHARDS. *J. Franklin Inst.*, **151**, 445–455; **152**, 59–63.—The paper deals with the recovery or utilization of silver, tin, zinc, antimony, bismuth, lead, and mercury, from the various wastes produced in the arts. Scrap tin as tin plate averages about 3 per cent. tin, while the cleaned iron has value for puddlers' use. The tin clippings, held in a wooden cage, were immersed in a cask containing hydrochloric acid for ten minutes, or until the tin was dissolved. The cleaned scrap was washed in water, immersed in a tank of lime water, washed again, and dipped into copper sulphate solution for a short time. The film of copper sulphate deposited on the iron in this way, prevented rusting. The iron was then worked into blooms for sheet metal. The acid finally became neutralized and yielded a solution of tin chloride. Into this solution the wooden cage, now filled with scraps of galvanized iron, was put, whereby metallic tin was precipitated by the zinc, and a solution of zinc chloride obtained. The precipitated tin was melted into ingots, and sold, about 600 pounds being obtained from 10 tons of scrap. The zinc chloride liquor was sold for disinfectant purposes and for fire-proofing wood. It is now proposed to deposit the tin electrolytically. Galvanizing wastes consist of sal-ammoniac skimmings composed of zinc oxide and the double chloride of zinc and ammonium; of zinc skimmings, containing zinc oxide and metallic zinc pellets; and of zinc dross, composed of an alloy of zinc and iron. The sal-ammoniac skimmings were leached with hot water and steam, recovering a solution of the zinc and ammonium chlorides, which was evaporated and recrystallized for use in the bath a second time; the residue, consisting of zinc oxide and metallic shot, was put into a tumbling barrel having fine openings through which the oxide escaped as powder, leaving the clean shot for remelting. The oxide was sent to the makers of zinc white. The treatment of the zinc-iron dross required much experimenting. By blowing in superheated steam and adding sulphur, the iron was separated. Cyanides had the same effect; so the dross was treated with ma-

Digitized by Google

terials which form steam and cyanides. A mixture of sulphur, potatoes (for their water content) and leather scrap was injected into the molten metal and boiled fifteen minutes; finally a definite, small amount of aluminum was added to deoxidize and render the metal perfectly fluid before it was bailed into molds. The addition of 5–10 per cent. aluminum also improves the galvanizing bath. Electricity was used in refining the zinc and yielded very pure metal, but was not a success financially. Mercury was removed from old zinc by refining as above in a covered pot having a condenser attached. The mercury distilled off readily. Zinky-lead was melted and allowed to stand, the zinc rose and the lead settled to the bottom. Keeping the heat just high enough to melt the lead, the floating, pasty zinc was skimmed off, and the lead cast into ingots. The lead contained about 3 per cent. zinc, but was useful in many ways. Britannia metal and pewter which had been silver-plated were stripped by dipping into nitric acid, and the silver was recovered by precipitation with salt and reduction with carbon. The residue of tin, lead, and antimony is used for type and Babbitt metals, the requisite amount of tin, lead, or antimony being added to correct the composition. Oxide skimmings from solder-making were washed to recover clean shot metal and then reduced with carbon. The crude metal was treated with zinc sulphate to remove arsenic, with sulphur to remove antimony, and with superheated steam to separate the iron. A continuous furnace was devised to do this, the copper and iron being partly slagged out and the other impurities volatilized. The crude metal is liquated on an inclined hearth, separating from the residue of copper, iron, and antimony. The copper and antimony residues are used for Babbitt metal, or, if containing an excess of copper, they are used in brass.

Soil Solutions. By F. K. Cameron. *U. S. Dept. Agr., Div. Soils, Bull.* 17.—In this bulletin are considered the nature and functions of soil solutions and the classification of alkali soils. The occurrence of small spots of alkali in the humid regions is also noted.

Solution Studies of Salts Occurring in Alkali Soils. By Frank K. Cameron, Lyman J. Briggs, and Atherton Seidell. *U. S. Dep't. Agr., Div. of Soils, Bull.* 18.—The following problems form the basis of these investigations: (1) the equilibrium between carbonates and bicarbonates in aqueous solution; (2) solubility of gypsum in aqueous solutions of sodium chloride; (3) solubility of gypsum in aqueous solutions of certain other electrolytes; (4) solubility of calcium carbonate in aqueous solutions of certain electrolytes in equilibrium with atmospheric air; (5) chemical examination of alkali soils; and (6) estimation of carbonates and bicarbonates in aqueous solution.

Digitized by Google

Process of Purifying Bauxite. By CHARLES M. HALL. *U. S. Pat. Nos. 677207, 677208, 678732.*—The object of the invention is to obtain a pure alumina suitable for reduction in the electric furnace, from impure bauxite containing silicon, as silicate of aluminium or other form, titanium, or iron. The process consists in fusing the bauxite with very little or no flux, in an electric furnace and subjecting it to a reducing action for sufficient time to reduce the impurities, leaving the greater part of the alumina unreduced. The impurities are caused to combine with a heavy metal such as iron, to form an alloy which segregates from the fused alumina, and may be removed. Bauxites containing iron in considerable amount furnish sufficient metal to alloy directly with the impurities. But if the iron content is small, it is best to add more metal or oxide to alloy with the reduced silicon and titanium. The bauxite is mixed with 5 to 10 per cent. of carbon (powdered coke, charcoal) and calcined to remove water. During calcination some iron is reduced to metal or lower oxides, thus lessening the work to be done in the electric furnace. The calcined bauxite is then mixed with more powdered carbon to bring the total amount to 8 or 10 per cent. and transferred to an electric furnace, which is lined with carbon. Very impure bauxite requires a higher percentage of carbon, but a large excess must be avoided as it wastes alumina and causes difficulty in the process. When the silicon and titanium are reduced and alloyed, the alumina is removed from the furnace.

Fertilizers. *Lab. Inland Revenue Dept., Canada, Bull.*, 75; *Me. Agr. Exp. Sta. Bull.*, 74; *N. C. Sta. Bull.*, 176, 15–22; *Bull.*, 177, 37–97; *Wash. Sta. Bull.*, 86; *Ky. Sta. Bull.*, 90; *Penn. Dept. Agr. Bull.*, 72; *Vt. Sta. Bull.*, 86; *Mass. Hatch Sta. Bull.*, 74; *Md. Agr. College Bull.*, 11; *N. C. Bd. Agr. Bull.*, 22; *La. Sta. Bull.*, 63, 483–576, 592–595; *Wis. Sta. Rep.*, 1900, 73–75; *Ky. Sta. Bull.*, 88, 125–173; *S. C. Sta. Bull.*, 64.

Report of Analyses of Paris Green and Other Insecticides in 1900. By L. L. VANSLYKE AND W. H. ANDREWS. *N. Y. Sta. (Geneva) Bull.*, 190, 283.—Twenty-two samples of Paris green and a number of proprietary insecticides were examined. Some variation was found in the arsenic content of the greens, but the commercial article was considered quite satisfactory. Microscopic examinations of the greens as a test of their purity gave no satisfactory results.

Marls. By H. A. HUSTON, W. J. JONES AND A. H. BRYAN. *Ind. Sta. Rep.* 1900, 76–77.—This is a study of the marls found in the State, with analyses of several of them and a discussion of their use in fertilizer- and cement-making.

Digitized by Google

Utilization of Sugar-Beet Waste. By MAX J. BEAHR. *U. S. Consular Rep.*, **66**, 357–360.—The question of utilizing the leaves and beet heads which are cut off when the beets are gathered, has been solved to a certain extent in the past, by leaving the material on the ground for fertilizing. It has not been available for cattle food because of the dirt with which it is mixed, and when put into a silo, the fermentation causes very great loss of structural constituents. Moreover, the fresh leaves contain oxalates of sodium and potassium, which act as poisons when fed to animals. But it is said that mixing lime with the leaves in the silo or adding it to the food, makes it available as food for stock. A process for drying this waste has been recently patented which makes possible its utilization as fodder. The material is dried by hot air in a revolving drum and the oxalates are said to be decomposed by this process, and yet the sugar content preserved. The leaves are then sliced into thin sections and the drying completed. The sand and earth are shaken out of the mass during the process of drying.

Artificial Stone. By JOHN L. BITTINGER. *U. S. Consular Rep.*, **66**, 361–362.—This is an account of the invention of W. Owen, whereby quartzose sand and powdered hydraulic lime are mixed dry, packed tightly in strong steel molds and placed in boiling water under pressure of 60–70 lbs. per square inch. The water slakes the lime, which by its expansion, exerts great pressure on the mold. When the lime is completely slaked, the mold is opened and the contents present much the appearance of solid stone.

Mond Fuel Gas in Great Britain. By JAMES BOYLE. *U. S. Consular Rep.*, **66**, 515–517.—This report contains a fairly complete description of the Mond gas producer, with some details as to the use of the gas.

The Manufacture of Bronze Powders in Germany. By FRANK H. MASON. *U. S. Consular Rep.*, **67**, 65–68.—These powders are produced from leaves of "Dutch metal," an alloy of copper and spelter (impure zinc). The copper and spelter are melted together in graphite crucibles holding 400 lbs. of the alloy; this is cast into ingots 2 feet long by half an inch thick. These rods are rolled cold, into ribbons which are annealed over a wood fire to avoid discoloration by sulphur. After softening they are cleaned in an acid bath, cut up and put under hammers, and beaten into thin foil. The foil is again annealed and then beaten into leaf metal by hand. The powders are made by grinding the leaf metal into impalpable powder. Some olive oil having been added, the grinding is continued for one to four hours; then the excess of oil is removed by heating under pressure, and the powder graded by putting it into a centrifugal machine and whirling,

Digitized by Google

the powder depositing on enclosed shelves according to its gravity, the finest dust on top, and the coarser material at the bottom.

BIOLOGICAL CHEMISTRY.

A. G. WOODMAN, REVIEWER.

On the Toxic Value of Mercuric Chloride and its Double Salts. BY JUDSON F. CLARK. *J. Phys. Chem.*, **5**, 289–316.—The author finds that the toxic effect of very dilute mercuric chloride solutions upon molds, yeasts, bacteria, or phanerogams, is greatly increased by the first additions of alkali-metal chlorides or hydrochloric acid, but is decreased by much larger additions. As the mercuric chloride becomes more concentrated, the increase due to the added substance becomes less, and finally disappears; and mixtures of mercuric and sodium chlorides were prepared which actually became more toxic when largely diluted. The author attributes the increase in toxicity caused by the first additions of substance, to the complex ions ($HgCl_4''$) and the subsequent decrease to the conversion of these into the undissociated complex salt (Na_2HgCl_4).

On Bilirubin, the Red Coloring-Matter of the Bile. BY W. R. ORNDORFF AND J. E. TEEPLE. *Am. Chem. J.*, **26**, 86–92.—Bilirubin, prepared from ox gall-stones, was purified and finally crystallized from pure dimethyl aniline. The product was completely soluble in chloroform and left no residue on ignition. The nitrogen in it, determined by the Kjeldahl and by the absolute method, was 9.21 per cent., the theory for $(C_{16}H_{18}N_2O_3)_x$, requiring 9.81. The results of analysis agreed fairly well with the formula $C_{34}H_{36}N_4O_7$. Attempts to determine the molecular weight of bilirubin were unsuccessful. Experiments made to learn its exact constitution indicated that it contains neither an alkoxy group nor crystal alcohol. Studies in this direction are still in progress.

Studies on the Vegetable Proteids. BY THOMAS B. OSBORNE. *Ann. Rep. Conn. Agr. Expt. Sta.*, **1900**, 388–471.—In continuation of his valuable work on the vegetable proteids the author has made a special study of the globulin edestin, which offers exceptional advantages for investigation. The reactions of edestin with definite quantities of acids and alkalies have been closely studied and the basic character of the proteids more firmly established. The amount of total and of loosely bound sulphur in a number of proteids has been determined. For a detailed account of the methods employed and the results attained reference should be made to the original paper.

The Chemical Nature of Enzymes. BY P. A. LEVENE.

Digitized by Google

J. Am. Chem. Soc., **23**, 505–508.—The claim has recently been put forward by Friedenthal that the enzymes possess the nature of nucleo-proteids. This is contradicted by the author, whose experiments on the self-digestion of trypsin showed that after six weeks nucleo compounds were entirely decomposed but the solution still possessed tryptic activity. Only those solutions were active which gave a biuret test, which would seem to indicate the proteid nature of trypsin.

Note on the Analysis of Nucleic Acids Obtained from Different Sources. By P. A. Levene. *J. Am. Chem. Soc.*, **23**, 486–487.—The analysis of vitellinic and ichtulinic acids showed that these two paranucleic acids of divergent origin have practically the same composition. The nucleic acids analyzed were those of the cod-fish pancreas and sperm, and of the Bacillus tuberculosis. The glycogen which precipitates with nucleic acid from tissues can be removed by means of copper chloride with which the nucleic acid forms a salt insoluble in water, while the glycogen copper compound is soluble.

On the Excretion of Kynurenic Acid, II. By Lafayette B. Mendel and Edward C. Schneider. *Am. J. Physiol.*, **5**, 427–456.—Kynurenic acid is regularly found in the urine of fasting dogs. It is always present when the putrefactive processes in the intestine have been completely checked by calomel, and the excretion of it is augmented by iodoform. With salol and naphthalene the output is checked. Poisons like phosphorus and phlorhizin, which stimulate proteid katabolism, greatly increase the output of kynurenic acid. The acid is not obtained after feeding elastin, hydrated cartilage, ovomucoid, or thymus alone, these substances producing effects comparable to that of gelatin, but is obtained after the ingestion of pancreatic and lymphatic glands, blood-fibrin and the pure vegetable proteid amandin. When proteids are broken down beyond the point where products giving the biuret reaction are present, the organism no longer responds in the usual way and kynurenic acid is not formed. Attempts to obtain evidence of the synthesis of kynurenic acid from tyrosin under various conditions failed.

A Preliminary Report on the Active Principle of the Suprarenal Gland. By T. B. Aldrich. *Am. J. Physiol.*, **5**, 457–461.—The author has separated in a pure form the active principle of the suprarenal gland, described by Takamine (*Therapeutic Gazette*, 1901, 221), under the name "Adrenalin." An analysis of the substance gave the following figures: C = 57.89; H = 7.23; N = 7.50; O = 27.27. The simplest body calculated from these data has the empirical formula, $C_9H_{13}NO_3$. The suggestion is made that the active principle of this gland is connected with the "epinephrin" of Abel.

Digitized by Google

The Formation of Allantoin from Uric Acid in the Animal Body. By Robert E. Swain. *Am. J. Physiol.*, 6, 38–47.—The author has shown experimentally, as has been demonstrated previously by others, that allantoin is excreted by the dog after ingestion of uric acid. Considerable amounts of the latter substance, however, may go beyond the allantoin stage. After uric acid feeding the output of uric acid in the urine is only slightly increased.

Some Decomposition Products of the Crystallized Vegetable Proteid Edestin. By P. A. Levene and Lafayette B. Mendel. *Am. J. Physiol.*, 6, 48–52.—It is shown that edestin resembles the ordinary animal proteids in yielding the three known hexon bases, arginin, lysin, and histidin, and differs from the alcohol-soluble proteids of vegetable origin which fail to yield lysin among their decomposition products.

Some Points in the Early History and Present Condition of the Teaching of Chemistry in the Medical Schools of the United States. By J. H. Long. *Science*, 14, 360–372.—This most interesting historical sketch and discussion of present conditions constituted the vice-presidential address before the Section of Chemistry at the Denver meeting of the American Association for the Advancement of Science. It is, unfortunately, impossible to review it adequately.

The Origin of Oxalic Acid from Protein and Protein Derivatives. By Arthur E. Austin. *Boston Med. Surg. J.*, 145, 181–186.—Laboratory tests and feeding experiments are described which indicate that oxalic acid is derived from the carbohydrate group in albumins, first passing, however, through the stage of glycocoll, the remainder of the protein being converted to urea. This process is essentially a vital one though imitated by strong oxidizing agents. Oxalic acid may also be derived from uric acid by fermentative action and oxidizing agents, possibly also by vital processes. It is probable that oxalic acid is a metabolic product, being present in many organs of the body, practically absent in the solid excretion of animals fed on foods which do not contain it, yet found always in the urine after long periods of fasting.

Digitized by Google

[CONTRIBUTION FROM THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VII. NO. 12.

ARTHUR A. NOYES, Editor; A. G. WOODMAN, Associate Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and F. J. Moore; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and C. H. Warren; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

Note on the Variation of the Specific Heat of Water between 0° and 100° C. BY H. L. CALLENDAR AND H. T. BARNES. *Phys. Rev.*, 10, 202–214.—The method used consisted in measuring, by means of a pair of differential platinum thermometers, the rise of temperature in a continuous stream of water, which was heated by a constant electric current of measured intensity and potential, passed through a platinum wire in the axis of the flowing water. Assuming Lord Rayleigh's value of the electrochemical equivalent, and Kahle's, and Carhart and Guthe's value for the Clark cell, the authors' value of the calorie at 20° coincides with that of Rowland (4.181 joules). The following values of it at different temperatures are deduced by the authors from their measurements, which were made at temperatures between 0° and 86°:

10°	4.190	30°	4.176	70°	4.188
15°	4.185	40°	4.174	80°	4.195
20°	4.181	50°	4.176	90°	4.203
25°	4.178	60°	4.181	100°	4.212

The minimum value lies at about 40°. Below 10° the value increases very rapidly, becoming about 4.23 at the freezing-point.

On the Temperature of the Acetylene Flame. BY EDWARD L. NICHOLS. *Phys. Rev.*, 10, 234–252.—By using thermo-electric junctions of varying cross-section and extrapolating for zero cross-section, the author finds the maximum temperature in the acetylene flame to be about 1900°, in the flat luminous flame of illuminating gas, 1780°, and in acandle flame, 1670°, the melting-point of pure platinum being taken as 1775°.

Digitized by Google

On the Gas Thermometer at High Temperatures. By Ludwig Holborn and Arthur L. Day. *Am. J. Sci.*, **160**, 171–206.—With reference to high-temperature thermometry, the authors have determined the expansion from 250°–1000° of pure platinum, of a platinum-iridium alloy with 20 per cent. iridium, and of Berlin porcelain; have compared up to 1100° a platinum —platinum-rhodium thermo-element with a nitrogen thermometer having a platinum-iridium bulb; have calculated from this comparison and their previous measurements the relation between electromotive force and temperature for this and four other thermo-elements composed of various platinum metals; and have determined the melting-points of eight metals either by the "wire method," in which a short wire of the metal to be melted is introduced into the hot junction of the thermo-element itself and the electromotive force observed when the metal melts and interrupts the circuit, or by the more exact "crucible method," in which a larger quantity of the metal is melted in a crucible, and the thermo-element, protected by porcelain tubes, is inserted. The crucible method was used, either alone or with the wire method, in all cases except that of gold. The following melting-points, referred to the nitrogen thermometer, were obtained:

Cadmium	321.7°	Aluminum.....	657°
Lead	326.9	Silver	961.5
Zinc	419.0	Gold	1064.0
Antimony	630.6	Copper	1084.1

When melted in the air, both silver and copper gave lower values (955° and 1064.9°). The absolute accuracy (estimated at 1° up to 1150°) and the causes of variation of thermoelectric measurements are discussed.

On the Melting-point of Gold. By Ludwig Holborn and Arthur L. Day. *Am. J. Sci.*, **161**, 145–148.—The authors have confirmed with a new sample of gold both by the "wire method" and the "crucible method" (see preceding review) their previous result (1064.0) obtained by the wire method alone. The crucible method gave 1063.5° and the wire method 1063.9°.

Reaction Velocity. By Robert Hart Bradbury. *J. Franklin Inst.*, **147**, 463–474; **148**, 65–74.—In these articles is given a clear presentation of the most important principles relating to the velocity of the chemical reactions. They contain nothing original.

The Spectra of Hydrogen and the Spectrum of Aqueous Vapor. By John Trowbridge. *Am. J. Sci.*, **160**, 222–230.—Experiments with very powerful condenser discharges have led the author to believe that the four-line spectrum of hydrogen is really due to aqueous vapor, which is liberated by such discharges from the glass walls of even the most carefully dried tubes.

Digitized by Google

On the Arc-Spectra of Elements of the Platinum Group. By H. KAYSER. *Astrophys. J.*, 7, 93–113; 173–197. **Arc-Spectra of Vanadium, Zirconium, and Lanthanum.** By HENRY A. ROWLAND AND CALEB N. HARRISON. *Astrophys. J.*, 7, 273–294, 373–389. **I. On the Series Spectra of Oxygen, Sulphur, and Selenium. II. On the Compound Triplets in the Line Spectrum of Mercury.** By C. RUNGE AND F. PASCHEN. *Astrophys. J.*, 8, 70–101; 13, 49–51. **A Determination of the Wave Lengths of the Principle Lines in the Spectrum of Gallium.** By W. N. HARTLEY AND HUGH RAMAGE. *Astrophys. J.*, 9, 214–220. **The Present Status of Kirchhoff's Law.** By A. COTTON. *Astrophys. J.*, 9, 237–268. **I. On the Red End of the Red Argon Spectrum. II. On the Spectra of Krypton. III. On the Spectrum of Radium.** By C. RUNGE. *Astrophys. J.*, 9, 281–283; 10, 73–79; 12, 1–3. **The Effect of Certain Impurities on the Spectra of Some Gases.** By PERCIVAL LEWIS. *Astrophys. J.*, 10, 137–163; 12, 16–23. **On the Effect of Pressure upon the Wave Lengths of the Lines of the Hydrogen Spectrum.** By J. WILSING. *Astrophys. J.*, 10, 269–271. **The Arc Spectrum of Vanadium.** By B. HASSELBERG. *Astrophys. J.*, 10, 343–361; 11, 67–88. **A Second Spectrum of Hydrogen beyond Wave Length 185 $\mu\mu$.** By VICTOR SCHUMANN. *Astrophys. J.*, 11, 312–313. **Note on the Spectrum of Silicon.** By FRANZ EXNER AND EDUARD HASCHEK. *Astrophys. J.*, 12, 48–49. **The Spectra of Mercury.** By WILLIAM B. HUFF. *Astrophys. J.*, 12, 103–119. **Standard Lines in the Arc Spectrum of Iron.** By H. KAYSER. *Astrophys. J.*, 12, 329–335. **The Spectrum of Hydrogen Given by the Metallic Arc of Tin, Copper, Silver, Etc.** By O. H. BASQUIN. *Astrophys. J.*, 14, 1–16. **The Absorption Spectrum of Chlorine.** By ELIZABETH R. LAIRD. *Astrophys. J.*, 14, 85–115.—The foregoing list of titles and references will serve to call the attention of those interested in spectroscopic work to the many articles upon that subject published in the *Astrophysical Journal.*

H. M. GOODWIN, REVIEWER.

An Hermetically Sealed Type of Clark Standard Cell. By H. T. BARNES. *Phys. Rev.*, 10, 268–276.—The details of the construction of an hermetically sealed Clark cell are described. The type is that known as the (English) "Board of Trade Crystal Cell." The advantages claimed are the absence of diffusion-lag and greater sensitiveness to temperature changes on account of its small size. The construction permits of its being directly immersed in a thermostat. Between 0° and 30° the following formula was found to express its electromotive force (E) in millivolts:

$$E_t = E_{15} - 1.200\ (t - 15) - 0.0062\ (t - 15)^2.$$

Digitized by Google

This agrees very well with the formula given by Jäger and Kahle.

$$E_t = E_{15} - 1.19\,(t - 15) - 0.007\,(t - 15)^2.$$

The Various Determinations of the E. M. F. of the Clark Cell. By HENRY S. CARHART. *Phys. Rev.*, **12**, 129–136.—The author reviews the various determinations of the electromotive force of the Clark cell from Latimer Clark's first determination in 1872 down to the recent determinations made by himself at the Reichsanstalt. The following table contains the results of all important determinations of this quantity reduced to common terms and 15° :

Observer.	Date.	Method.	Result.
Clark	1872	Absolute	1 4378
Carhart	1882	Silver voltameter	1.4329
Rayleigh	1884	Absolute	1.4345
Ettinghausen	1884	Silver voltameter	1.434
Glazebrook and Skinner	1892	Silver voltameter	1.4344
Kahle	1896	Absolute	1.4322
Jaeger and Kahle	1898	Silver voltameter	1.4328
" " "	1899	Silver voltameter	1.4329
Carhart and Guthe	1899	Absolute	1.4333

Omitting Clark's determination, as his cells are not strictly comparable with the others on account of the use of boiled solutions of zinc and mercurous sulphate, the mean of the remaining three absolute determinations is 1.4333 volts at 15°. From this it would appear that the electromotive force of the Clark cell at 15° is nearer 1.433 volts than 1.434 volts.

The Effect of Gravity and Pressure on Electrolytic Action. By ROLLA R. RAMSEY. *Phys. Rev.*, **13**, 1–31.—When a metal is transferred electrolytically from anode to cathode, the work done is different when the transfer takes place vertically upward against gravity than when the electrodes are placed horizontally. If, therefore, an electrolytic cell, in which a current is flowing, be suddenly rotated from a horizontal to a vertical position, a counter electromotive force should be developed, as was first pointed out by Maxwell in 1878. This prediction was later verified by experiments of the electrolysis of chlorides of the metallic earths. These experiments are reviewed in an introductory historical summary. The original experiments described in this paper are on the effect of gravity on the electromotive force during the electrolysis of zinc or cadmium sulphate solutions. With a 10 per cent. zinc sulphate solution the electromotive force of polarization was found to be negative, so that the resulting current flowed up the tube opposite to gravity. This result is in agreement with theory, for when 32.5 grams of zinc are carried up with the current, 57.7 grams of SO_4 are carried down to the opposite electrode, and the electromotive force observed is due to

Digitized by Google

the excess of the mass of the SO_4 over that of the zinc. The results obtained with cadmium sulphate solutions were more concordant than those with zinc solutions. With a 10 per cent. solution the electromotive force per centimeter of height was -1.75×10^{-6} volts; with a 46 per cent. (nearly saturated) solution the observed value per centimeter of height was $+4.78 \times 10^{-6}$ volts. The effect of pressure on the electromotive force of various cells (the Clark, cadmium, calomel, and others) was also studied by connecting two similar cells in opposition and varying the pressure in one of them, even up to 300 atmospheres. In general, the observed electromotive force of the combination increased linearly with the pressure; but a copper sulphate cell and an old (black) silver chloride cell were exceptions, the electromotive force of the former diminishing slightly with the pressure, while that of the latter at first increased very rapidly, and afterwards diminished.

A New Solution for the Copper Voltameter. By WILLIAM K. SHEPARD. *Am. J. Sci.*, **162**, 49–56.—In order to increase the limits between which the current density may be varied in a copper voltameter, the author has investigated the effect of the addition of a small per cent. of ammonium chloride to the copper sulphate solution, the presence of this salt in a copper nitrate solution having been found by Beach to increase considerably the limits between which it could be used. The solution was prepared as follows: A saturated copper sulphate solution was boiled for a short time and then maintained at 100°, for about an hour, in contact with metallic copper, in order to neutralize the solution. About 0.05 per cent. of ammonium chloride was then added. Experiments with this solution showed that deposits reliable to 0.1 per cent. could be obtained with current densities varying from 2 amperes to 7 amperes per square decimeter, and at temperatures from 20° to 40°.

Polarization and Internal Resistance of Electrolytic Cells. By MARTIN D. ATKINS. *Phys. Rev.*, **13**, 102–125, 182–192.—The object of this investigation was to test the applicability of Wiedeburg's theory of polarization to various electrolytic cells. The two principal problems investigated were the effect of current on the apparent change of internal resistance of a cell and the closeness with which the formulæ derived from Wiedeburg's theory represented these experimental results. The apparatus was so arranged that, by means of a series of contacts operated by a pendulum, a current was caused to flow through an electrolytic cell and a known resistance, and the potential around each of these in succession was caused to charge a condenser which was immediately after discharged through a ballistic galvanometer. The apparent internal resistance of the cell was then compared with the values calculated from the theory. The principal re-

Digitized by Google

sults of the investigation may be summarized as follows: 1. Electrodes of copper in copper sulphate and zinc (as amalgamated plates or as liquid amalgam) in zinc sulphate gave, with varying currents, results in complete agreement with a formula of the Bartoli-Wiedeburg form, when they were *first* placed in their solutions. The internal resistance of these cells is therefore constant in accordance with the assumptions of the theory. 2. Electrodes of silver in silver nitrate and zinc (not amalgamated) in zinc sulphate also show, on the whole, a satisfactory agreement with the theory. 3. Polished platinum electrodes in sulphuric acid do not agree with the requirements of the theory. 4. All of these electrodes, in their respective solutions, show a very marked rise in the apparent resistance on standing, but the results do not indicate that this is an increase of the real resistance of the cell. 5. The experiments made to test the effect of the size of the electrodes and time of flow of current in the cell on the constants of Wiedeburg's formula do not confirm the theory, although an equation of the general form of that proposed seems to satisfy best the curves obtained for the internal resistance and polarization of the cells investigated.

Secondary Reactions in Electrolysis. By JOSEPH W. RICHARDS. *J. Franklin Inst.*, **152**, 201–225.—The purpose of this paper is a classification of the numerous types of secondary reactions occurring in electrolysis and the calculation of the voltage necessary to effect decomposition in any given case. All these calculations are based on the application of the so-called Law of Thomson to the thermochemical data corresponding to the formation of the final products of the electrolysis. The author's classification of secondary reactions is practically the same as that given by Ostwald, with additional sub-divisions. It is as follows: (1) The ions polymerize into more complex forms; (2) The ions decompose or dissociate into simpler forms; (3) The ions react with the electrodes; (4) The ions react with the electrolyte. Group (3) is further subdivided into reactions at the anode, and reactions at the cathode; in either case the electrode may be a solid or a liquid; and the resulting secondary product may be (*a*) a gas, (*b*) a liquid, or (*c*) a solid, and may be either soluble or insoluble in the electrolyte. Similarly, under group (4) are considered all the different possibilities in regard to the nature of the products of oxidizing actions at the anode, and reducing actions at the cathode. Numerous excellent examples are given to illustrate each group of the above classification.

Electrochemical Action. By C. J. REED. *J. Franklin Inst.*, **151**, 369–393, 401–413; **152**, 46–58.—In these articles the author sets forth at length his views regarding the theory of the electrochemical action in primary batteries and decomposition cells, of

Digitized by Google

polarization, and of the nature of electrolytic conduction. He does not consider the assumption of the existence of free ions, Arrhenius' Dissociation Theory, or even the conception of the migration of ions during electrolysis, at all necessary to explain any of the known electrochemical phenomena. The substitute which he offers is a modified form of the time-honored Grotthus' chain hypothesis, for the details of which the reader is referred to the original articles.

Thermodynamics of the Voltaic Cell. By HENRY S. CARHART. *Phys. Rev.*, 11, 1–13.—The author gives a deduction of the Gibbs–Helmholtz formula for the electromotive force of a voltaic cell in terms of the separate temperature coefficients of the two electrodes, instead of in terms of the resultant temperature-coefficient of the cell. The formula was tested by following, by means of thermal couples of iron and constantan wire, the temperature-changes produced in the solutions surrounding the electrodes of a Daniell cell. The two halves of the cell were exactly similar and were separated by a plate of fine unglazed porcelain. The difference of temperature per second, as indicated by the junctions, was found to be proportional to the current, as theory required, and the observed value agreed well with that calculated from thermochemical data and the heat capacity of the cell.

The Electromotive Force of Metals in Cyanide Solutions. By S. B. CHRISTY. *Trans. Am. Inst. Min. Eng.*, 30, 864–946.—The first twenty-six pages of this article are devoted to an excellent condensed statement of Nernst's theory of the voltaic cell, and of the theory of solutions and electrolytic dissociation on which the theory is based. The reason why the arrangement of the metals in a voltaic series differs with the nature of the solution with which they are in contact is explained. Particular attention is devoted to the case of cyanide solutions, in which the ions of the heavy metals cease to exist as such except in minute quantities, being held in combination as a part of a complex anion. The experimental part of the paper contains the results of measurements of the absolute potential difference between a large number of metals in contact with potassium cyanide solutions of concentrations varying from normal to millionth normal. The potentials were measured by means of an Ostwald normal electrode; a Wiedemann galvanometer was used as measuring instrument, both the deflection and Poggendorf. compensation method being employed. The results are discussed graphically, first by the direct method, *i. e.*, plotting potential differences as ordinates and concentrations as abscissae, and second by the logarithmic method, that is, with potential differences as ordinates and logarithms of the concentration as abscissae. By Nernst's theory the absolute potential difference (π) between a metal and a solution is given by the formula:

Digitized by Google

$$\pi = \text{const. } ln \frac{P_M}{p} = \text{const.} - \text{const. } ln\ p,$$

where p, the osmotic pressure of the kation, is proportional to its concentration (c); hence it follows that if π is plotted as ordinates and $ln\ p$, or its proportional quantity $ln\ c$, as abscissae that the points should lie along a straight line. The metals zinc, copper, gold, silver, lead, mercury, and iron were investigated, and the results discussed in conjuction with those of von Oettingen. In general, the potential decreased with increasing dilution, according to the logarithmic formula up to dilutions of 1,000 to 10,000 liters. Beyond this dilution the potential decreased very much less rapidly. The order of the metals in normal cyanide solutions was found to be zinc, copper, gold, silver, lead, mercury, iron. In very dilute solutions the order became zinc, lead, iron, copper, silver, gold, mercury. The last part of the paper is devoted to a consideration of the question of the variation of the solvent power of cyanide solutions for gold, with the concentration, and with the amount of air or oxygen dissolved. Experiments on the solubility of similar gold strips rotated twenty-four hours under like conditions in cyanide solutions of various strengths showed no appreciable solvent action when the solution contained less than 0.001 per cent. The solubility increased rapidly at concentrations greater than 0.0005 normal. The same was true when a large amount of air was present in the bottles containing the metal and solution. Experiments show that the solvent action of the cyanide is unquestionably increased by the presence of dissolved oxygen, and that the reason why the solvent action becomes a maximum in a 5 to 10 per cent. solution is, that at this concentration the combined effects of the dissolved oxygen, and of the potential difference between the metal and the solution attains its greatest value. The effect of the presence of hydrogen peroxide in solution was also studied. The experiments described suggest several interesting lines of work for further investigation.

INORGANIC CHEMISTRY.

HENRY FAY, REVIEWER.

Potassium Perselenate—Preliminary Note. BY L. M. DENNIS AND O. W. BROWN. *J. Am. Chem. Soc.*, **23**, 358–359.—Potassium perselenate was prepared by the electrolysis of a cold saturated solution of potassium selenate containing free selenic acid. The product separates upon the anode as a white powder. When hot, potassium perselenate oxidizes manganese dioxide to potassium permanganate, and oxidizes thallous and ferrous sulphate in the cold.

Digitized by Google

The Reaction between Chlorine and Ammonia. By William A. Noyes and Albert C. Lyon. *J. Am. Chem. Soc.*, **23**, 460–463.—The authors have shown by quantitative experiments that the reaction between chlorine and ammonia takes place according to the reaction: $12NH_3 + 6Cl_2 = N_2 + NCl_3 + 9NH_4Cl$, when the ammonia is used very nearly in the proportion indicated. If an excess of ammonia is used it reacts with the nitrogen trichloride, giving free nitrogen and ammonium hypochlorite.

On the Decomposition of Sodium Nitrate by Sulphuric Acid, II. By C. W. Volney. *J. Am. Chem. Soc.*, **23**, 489–492.—The author considers that the reaction between sulphuric acid and sodium nitrate takes place in two phases. The first takes place below 100°, according to the reaction:

$$NaNO_3 + 2H_2SO_4 = NaH_3(SO_4)_2 + HNO_3;$$

on raising the temperature the second phase takes place according to this reaction:

$$NaH_3(SO_4)_2 + NaNO_3 = NaH(SO_4)_2 + HNO_3.$$

The Sulphohalides of Lead. By Victor Lenher. *J. Am. Chem. Soc.*, **23**, 680–682.—The sulphohalides of lead are readily prepared by dissolving lead sulphide in the halogen acid and diluting this solution with water. The chlor- and bromsulphide separate immediately as red precipitates. An excess of water converts this precipitate into black lead sulphide.

The Crystallization of Copper Sulphate. By Arthur John Hopkins. *Am. Chem. J.*, **25**, 413–419.—In the preparation of crystals of copper sulphate from 20–30 mm. in length, the author was guided by the following principles: I. In the process of crystallizing copper sulphate, at constant room temperature, the solubility is a constant and the concentration, minus this constant, is the total weight of crystal deposit. II. (*a*) In a solution, supersaturated in absolute quiet, no crystals will form. (*b*) In a solution supersaturated in absolute quiet, the number of crystal points formed by the first disturbance is the same as the number of crystals formed. (*c*) The ratio between the number of crystals formed and the weight of crystal deposit determines the size of the crystals. III. For a given volume of solution and given size of crystals and weight of crystal deposit, the diameter of the crystallizing dish determines the space between the crystals. Experiments showed that the best conditions were obtained when 171 grams of copper sulphate were dissolved in water and 15 cc. of normal sulphuric acid, and the whole evaporated to less than 340 cc., and then diluted to exactly that volume with boiling water. As the ratio of the volume of solution to the horizontal surface of the crystallizing dish is identical with the depth of solution, a dish 26 cm. in diameter was selected so as to have a depth of

Digitized by Google

liquid of 6.3 mm. for the above concentration. In order to obtain the proper number of crystal points, a blast of air was blown on the surface of the solution until the desired number of crystals were started. The dish was then allowed to stand at constant temperature over night. On crystallization at 23°, 275 cc. of mother-liquor and 78 grams of crystals, 20–30 mm. in length, were obtained. In order to concentrate the mother-liquor to such a volume as to produce a proportionate crop of crystals, it was calculated that any saturated solution of copper sulphate must be evaporated to 67.1 per cent. of its volume.

On the Formation of Platinum Tetrachloride from Aqueous Hydrochloric Acid by Atmospheric Oxidation in Contact with Platinum Black. By J. W. MALLET. *Am. Chem. J.*, **25**, 430. —It was found that when platinum black was washed with a fairly strong aqueous solution of hydrochloric acid it was dissolved to a small extent with the formation of platinum tetrachloride.

On the Purification of Caesium Material. By H. L. WELLS. *Am. Chem. J.*, **26**, 265–268.—The use of the double salt, $2CsCl.PbCl_4$, has been found very convenient for the separation of caesium, particularly after a large part of the caesium has been removed by some other means. To accomplish this, the author separates the greater portion in the form of the salt $3CsCl.2SbCl_4$, as recommended by Godeffroy, except that a much less concentrated hydrochloric acid is used. The filtrate then carries a small amount of caesium, which is precipitated as $2CsCl.PbCl_4$ when 2 or 3 grams of lead nitrate per liter are added, and the solution is saturated with chlorine gas. The caesium in the antimony double salt is recovered by treating the salt with boiling dilute ammonium hydroxide. In the filtrate from the antimonious hydroxide, the large amount of ammonium chloride is removed by several evaporations with strong nitric acid. The caesium nitrate can be further purified by recrystallization, or by dissolving the nitrate and an equivalent weight of iodine in 10 parts of 1 : 1 hydrochloric acid at a temperature just below boiling. On cooling, the salt $CsCl_2I$ separates, practically free from rubidium, lithium, sodium, and potassium.

On a Salt of Quadrivalent Antimony. By H. L. WELLS AND F. J. METZGER. *Am. Chem. J.*, **26**, 268–271.—The double salt $2CsCl.SbCl_4$, which had been previously made by Setterberg by boiling a solution of antimony trichloride in strong hydrochloric acid, with antimony pentachloride and caesium chloride in excess, was found to be isomorphous with the salt $2CsCl.PbCl_4$. The color of the octahedral crystals is black, but the powdered crystal is dark blue.

Digitized by Google

On the Acid Nitrates. By H. L. Wells and F. J. Metzger. *Am. Chem. J.*, **26**, 271–275.—In addition to the acid nitrates described by Ditte, the authors have prepared and studied the properties of the new salts, $RbNO_3.HNO_3$, $RbNO_3.2HNO_3$, $CsNO_3.HNO_3$, $CsNO_3.2HNO_3$, $TlNO_3.2HNO_3$. The monacid salts are readily prepared by saturating nitric acid, of sp. gr. 1.42, with the normal nitrates at a gentle heat and cooling till crystallization occurs. For the diacid salts, it was necessary to use nitric acid of 1.50 sp. gr. and to cool in a freezing-mixture.

Investigations on Double Nitrates. By H. L. Wells, H. P. Beardsley, G. S. Jameson, and F. J. Metzger. *Am. Chem. J.*, **26**, 275–278.—It was found impossible to prepare double nitrates of caesium and the bivalent metals; but with ferric nitrate, caesium nitrate forms a yellow deliquescent salt, melting at 33°–36°, having the composition represented by the formula $Cs.NO_3.Fe(NO_3)_3.7H_2O$, and with bismuth nitrate, colorless, prismatic crystals of caesium bismuth nitrate, $2CsNO_3.Bi(NO_3)_3$, were obtained by evaporating a nitric acid solution of the two nitrates. When thallous nitrate is dissolved in concentrated nitric acid by the aid of heat a part of the salt is oxidized, and a thallous thallic nitrate of the composition $2TlNO_3.Tl(NO_3)_3$ separates on cooling.

On Caesium Periodate and Iodate-Periodate. By H. L. Wells. *Am. Chem. J.*, **26**, 278–281.—Caesium periodate was formed by adding caesium carbonate to a concentrated solution of periodic acid. There was no evidence of the formation of any other than the normal periodate. By dissolving caesium iodate and periodate in dilute periodic acid, the iodate-periodate, $HCsIO_3.IO_4.2H_2O$, crystallizes out in white prisms on evaporation.

On the Caesium-Antimonious Fluorides and Some Other Double Halides of Antimony. By H. L. Wells and F. J. Metzger. *Am. J. Sci.*, **161**, 451–456.—By bringing together solutions of antimonious fluoride and caesium fluoride with some free hydrofluoric acid in varying proportions the following double salts were isolated: $CsF.3SbF_3$, $CsF.2SbF_3$, $4CsF.7SbF_3$, $CsF.SbF_3$, $2CsF.SbF_3$. The 3 : 2 type of salt has not been made, and this seems the more remarkable since this type is prominent among the chlorides, bromides, and iodides. The 1 : 3 and 4 : 7 type of caesium antimonious fluoride salts are not found among the other double halide salts, and the 3 : 4, 3 : 2, 7 : 3, 3 : 1, and 4 : 1 types have not been found for the double fluorides. Caesium-antimonious iodide, $3CsI.2SbI_3$, has been found to exist in a brick-red, octahedral form, and in yellow, hexagonal plates. The octahedral salt separates from solutions strongly acidified with hydriodic acid and the hexagonal salt from weakly acidified solutions. The composition of Setterberg's double chloride, CsCl.

Digitized by Google

$SbCl_5$, has been confirmed, but the corresponding double fluoride does not seem to exist. The only double fluoride of caesium and quinquivalent antimony which has been found is the one having the composition represented by the formula $CsF.SbF_4OH$.

On a Caesium-Tellurium Fluoride. By H. L. Wells and J. M. Willis. *Am. J. Sci.*, **162**, 190.—Under the widest range of conditions only one double fluoride of caesium and tellurium could be prepared. The salt, $CsF.TeF_4$, crystallizes in large transparent, colorless needles, and is readily decomposed by water.

On the Double Chlorides of Caesium and Thorium. By H. L. Wells and J. M. Willis. *Am. J. Sci.*, **162**, 191–192.—On bringing together thorium and caesium chlorides in varying proportions, two new salts, $3CsCl.ThCl_4.12H_2O$ and $2CsCl.ThCl_4.11H_2O$, were prepared. Attempts to prepare the double fluorides were not successful on account of the great insolubility of thorium fluoride.

ORGANIC CHEMISTRY.

J. F. Norris, Reviewer.

The Composition of a Wood Oil. By G. S. Fraps. *Am. Chem. J.*, **25**, 26–53.—The material used in the investigation was obtained from a hard-wood tar. The tar, after distillation, was treated with caustic potash and again distilled. The distillate so obtained, which boiled from 54° to 210°, was fractionated into portions which were collected at intervals of 5°. As a result of a careful investigation of the separate fractions, the following conclusions are drawn: The oil probably contains the series of aldehydes $C_nH_{2n}O$ up to caproic aldehyde. The quantity of these compounds is so small, however, that valeric aldehyde only was positively identified. Furfural is also present in small quantity. The following ketones were detected in the oil: dimethyl-, methylethyl-, methylpropyl-, and probably methyl-*n*-butyl- and diethyl ketones. Cyclopentanone and other ring ketones are also present. It contains nitriles in minute quantities and the methyl esters of acetic, propionic, *n*-butyric, and *n*-valerianic acids. Methyl caproate, heptoate, and isobutyrate are also probably present. Esters of unsaturated acids, which were not identified, were also found. The oil contains methyl-, dimethyl-, trimethyl-, and higher furanes. No dimethylacetal or appreciable quantities of pyridines or alcohols were discovered. Unsaturated compounds which unite with hydrochloric acid and bromine were shown to be present. The oil contains toluene and xylene, and probably cumene and cymene. It also contains creosote and minute quantities of phenol ethers. The higher-boiling oil, freed from ke-

Digitized by Google

tones, aldehydes, ethereal salts, and phenols, was separated into two parts by glacial acetic acid, the one soluble and the other insoluble. Both parts absorbed bromine readily.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

F. J. MOORE, REVIEWER.

The Occlusion of Magnesic Oxalate by Calcic Oxalate and the Solubility of Calcic Oxalate. BY THEODORE W. RICHARDS, CHARLES F. MCCAFFREY, AND HAROLD BISBEE. *Proc. Am. Acad.*, **36**, 377–393.—The authors sum up the results of their work as follows: "(1) All those conditions which tend to diminish the amount of undissociated magnesic oxalate in a solution tend to diminish the amount of this impurity in calcic oxalate precipitated from the solution. (2) Hence evidence is furnished supporting the hypothesis that occlusion is a distribution of an undissociated substance between the liquid and the "nascent" solid phase. (3) Magnesic oxalate is precipitated upon the calcic oxalate after this is deposited, although far more slowly than while it is being deposited. For this reason the filtration should be not too long delayed. (4) Calcic oxalate is sufficiently soluble in pure water to cause grave inaccuracies in precise quantitative work. (5) This solubility may be diminished, but not wholly prevented, by an excess of ammonic oxalate in the wash-water. (6) By heeding all these relations, a reasonably precise separation of magnesium and calcium may be made in a single precipitation. The details are as follows: The magnesium in the solution should be not much stronger than fiftieth-normal. About ten times the equivalent amount of ammonic chloride, and enough oxalic acid to combine with all the calcium, should be added to the mixed solution. It is well to diminish the dissociation of the oxalic acid beforehand by the addition of two or three times its equivalent amount of hydrochloric acid. To the boiling mixture, colored with a drop of methyl orange, should be added slowly a very dilute solution of ammonia, with continual stirring and occasional pauses. The final stages of neutralization should not be reached in less than half an hour. When the neutralization has been effected, a very large excess of ammonic oxalate should be added, and the mixture should be allowed to stand for four hours. The precipitated calcic oxalate should be thoroughly washed with water containing ammonic oxalate. The filtrate will contain all but about 0.1 or 0.2 per cent. of the magnesium, and the precipitate will contain all but about the same proportion of the calcium. (7) The precipitate, having been formed slowly from a solution in which it was somewhat soluble, is distinctly crystalline and far more easily handled than if it had been suddenly precipitated.

Digitized by Google

This is a general effect, which might render service in other cases."

Bismuth Assay. By A. W. Warwick and T. D. Kyle. *Eng. Min. J.*, 71, 459.—About 1 gram of "pulp" is treated with 5 to 10 cc. of concentrated nitric acid, and the solution evaporated to dryness on the hot plate. The residue is made up to about 100 cc. with boiling water. Five grams of ammonium oxalate are then added, and the whole is boiled vigorously for five minutes. The supernatant liquid is now decanted off, and the precipitated bismuth oxalate is changed to the basic compound by boiling with two successive portions of pure water of about 50 cc. each. The basic oxalate is now dissolved on the filter in about 5 cc. of warm dilute hydrochloric acid, the acid neutralized by ammonia, and then an excess of sulphuric acid added. The liberated oxalic acid may now be titrated with permanganate. The ammonia is added because the titration in hydrochloric acid solution gave a poor end-point, while the direct solution of the oxalate in sulphuric acid was impracticable on account of the time required. The whole process can be carried out within forty minutes, and yields results concordant within 0.1 per cent. The presence of lead, copper, zinc, arsenic, or tellurium does not interfere with the results.

The Electrolytic Determination of Copper. By Thorn Smith. *Eng. Min. J.*, 71, 659–660.—The author considers the electrolytic method superior to most of the volumetric methods in common use for commercial purposes, and the article is mostly devoted to showing how successful determinations can be made in a "works" laboratory without the aid of expensive apparatus and appliances. He shows, in brief outline, how different ores should be prepared for electrolysis.

Sampling Pig Iron. By Harrison Everett Ashley. *Foundry*, 18, 108–109.—The author criticizes articles by Scott and Field upon the same subject, and shows in much detail where he thinks borings should be made in a pig, in order to obtain a fair sample. The ideas presented are illustrated by elaborate diagrams.

Contributions to the Knowledge of Reversible Reactions. By W. N. Stull. *J. Am. Chem. Soc.*, 23, 508–514.—The author studies the action of hydrogen sulphide upon solutions of zinc and cadmium in hydrochloric and sulphuric acids. The results of his work, as far as they have a bearing upon chemical analysis, seem to show that a more complete separation of cadmium from zinc can be effected in sulphuric than in hydrochloric acid solution. An interesting detail in this connection is the fact that while cadmium sulphide is appreciably soluble in dilute sulphuric acid, even

Digitized by Google

in the cold, yet it may be rendered almost completely insoluble in this medium by keeping the liquid saturated with hydrogen sulphide.

Estimation of Hydrate in the Presence of Alkali Carbonate. By W. E. Ridenour. *J. Franklin Inst.*, **152**, 119–121.—The author tests the method of P.T. Thompson (Sutton's "Volumetric Analysis," 5th edition), and finds that when phenolphthalein is used as an indicator, it does not show half the carbonate under any circumstances. A definite ratio exists, however, between the amount actually present and that indicated by the titration. Correct results may therefore be obtained by the introduction of an arbitrary factor into the calculations.

Micro-Chemical Analysis. By E. M. Chamot. *J. Applied Microscopy*, **2**, 502–505; **3**, 719–723, 793–796, 817–824, 849–859, 965–969, 981–986, 1045–1051, 1077–1083; **4**, 1121–1128, 1189–1194, 1242–1249, 1289–1297, 1323–1330, 1373–1379, 1451–1458, 1495–1499, 1529–1533.—The above references are to a long series of papers now appearing in the journal mentioned. The treatment of the subject is adapted to the use of the beginner in chemical work with the microscope. Detailed directions for the ordinary manipulations are followed by a description of the characteristic reactions of the various elements, and the whole is illustrated by adequate cuts and diagrams. The reviewer has found many of the suggestions of much assistance in his own work, and it is hoped that the material presented in this series of articles may later be published in the form of a laboratory manual. A work of this kind is much needed in this interesting, though hitherto much neglected, field of analytical chemistry.

PROXIMATE ANALYSIS.

A. H. Gill, Reviewer.

The Accuracy of Carbonic Acid Determinations by the Arndt Gravity Econometer. By A. Bement. *Sibley J. Mech. Eng.*, **15**, 239–244.—The results show that the average of the readings of the instrument agree with the analyses. It does not, however, follow sudden fluctuations in the chimney gases.

Oil of Walnuts. By L. F. Kebler. *J. Franklin Inst.*, **151**, 394–395.—The examination of two commercial samples showed one to be dilute glycerine flavored with a menthol-like body, the other to be a mixture mainly of alcohol and nitrobenzene. The oil expressed from walnut-kernels had a specific gravity at 15° of 0.926, a saponification number of 186–197, an iodine value of 142–152, and a melting-point of the fatty acids of 16°–20°. It is said to be imported from France and Switzerland in 110 gallon tuns, and to be equal, if not superior, to linseed oil in drying qualities.

Digitized by Google

The Chemistry of Corn Oil. By H. T. Vulté and H. W. Gibson. *J. Am. Chem. Soc.*, **22**, 453–467.—The following constants were found as a result of closely agreeing determinations on three different samples.

Sp. gr. 15 5°.	Iodine value.	Saponification value.	Hehner value.
0.921–0.9255	113.3–119.7	191.5–193.7	88.1–93.2
Reichert value.	**Acetyl value.**	**Maumené test.**	**Valenta test.**
4.0–10.1	10.7–11.8	74°–75°	44°–74°

Phytosterol, or rather the unsaponifiable matter, amounted to 1.4 per cent. A dark brown coloration is produced by Bechi's test and an intense black by Brullé's test.

The Nature and Properties of Corn Oil. II. Determination of its Constitution. By H. T. Vulté and H. W. Gibson. *J. Am. Chem. Soc.*, **23**, 1–8. Stearic, palmitic, oleic, linolic, ricinoleic, formic, and probably caproic, caprylic, and capric acids had been previously found in corn oil. The presence in it also of acetic, hypogaeic, and arachidic acids was proved by this investigation. That of formic acid was also confirmed. The Reichert value is the highest of any seed oil, being about 4.2. The nature of the volatile oil was not considered.

A Comparison between the Bromine and Iodine Absorption Figures of Various Oils. By H. T. Vulté and L. Logan. *J. Am. Chem. Soc.*, **23**, 156–159.—The work is intended as a revision of the existing tables of these constants and has been carefully carried out, as is shown by the close agreement of the duplicates. It is difficult to see why twenty-four hours was chosen as the time for action of the iodine solution, when the usual practice is from two to four hours. Olive, cotton-seed, poppy-seed, linseed, almond, peanut, whale, lard, sperm, rape, castor, seal, cod-liver, menhaden, and resin oils were examined.

On the Heat of Combustion as a Factor in the Analytical Examination of Oils; and the Heats of Combustion of Some Commercial Oils. By H. C. Sherman and J. F. Snell. *J. Am. Chem. Soc.*, **23**, 164–173.—The article gives a résumé of the work done on the calorific value of oils and a description of the method employed. The calorimeter used was of the Atwater-Blakeslee type, the oil being absorbed upon fibrous asbestos and fired by an electrically-fused iron wire. The calorific power at constant volume of most of the oils is about 9400; that of boiled linseed and castor oils is 8800, and those of resin oil and petroleum are from 10,100 to 10,700 cal. The specific gravity, iodine number, and free-acid content are also given. It would hardly seem practicable to use the method as a means of detecting the adulteration of oils.

Digitized by Google

The Quantitative Estimation of Hydrogen Sulphide in Illuminating Gas. By C. C. TUTWILER. *J. Am. Chem. Soc.*, **23**, 173–177.—The estimation is effected by means of a Bunte burette containing the gas, in which the hydrogen sulphide is estimated by iodine solution run in from a 10 cc. burette attached to the top of the gas burette. Mercury is used as the confining liquid and to draw in the iodine solution. The apparatus is easily manipulated and accurate and should find extensive application in gas works.

The Determination of Hydrogen in Gas Mixtures. By F. C. PHILLIPS. *J. Am. Chem. Soc.*, **23**, 354–356.—This determination is effected by combustion with air by means of palladized asbestos, which is contained in a U-tube 3 mm. in diameter and 70 cm. in total length. Difficulty having been experienced in maintaining a uniform temperature, the tube is heated in a bright jacketed vessel, silvered to prevent radiation. It would seem that the apparatus should work well.

Gasometric Analysis. By F. X. MOERK. *Am. J. Pharm.*, **72**, 366–372.—This article deals with the estimation of spirits of nitrous ether, sodium nitrite, urea, and hydrogen dioxide by a simple apparatus, resembling that of Squibb, and charged with brine. The results upon hydrogen dioxide are a little higher than those of the U. S. pharmacopeia.

Notes on the Examination of American Oil of Peppermint for Menthol. By F. A. SIEKER. *Pharm. Rev.*, **19**, 66–67.—Attention is called to the fact that samples of oil of peppermint are condemned as not of the purity required by the pharmocopeia, simply because they are not cooled to a sufficiently low temperature (—21° C.). When this oil is rectified by steam 90 per cent. comes over, which contains one per cent. less menthol than the crude oil; a resinous residue is left after distillation, which indicates decomposition or polymerization of the oil.

On the Elimination and Quantitative Estimation of Water in Oils, Fats, and Waxes. By C. B. DAVIS. *J. Am. Chem. Soc.*, **23**, 487–488.—The process consists in exposing the substance to a temperature of 110° on a dried and weighed paper coil after the manner of the Adams' method for fat extraction in milk.

A Report upon Linseed Oil and Its Adulterations, Submitted to the Commissioner of Agriculture of New York State. By PARKER C. MCILHINEY.—This report deals very fully with the subject, the object being to ascertain first the charter of pure linseed oil as sold in New York State; second, what adulterants are used; and third, to what extent adulteration is practiced. The methods of preparation of raw and boiled oil are given, particular attention being paid to the various ways of manufacturing the

Digitized by Google

latter, especially by the addition of driers-making "bung-hole" oil. The analytical details embrace the determination of the specific gravity, of the action of bromine or iodine on the oil, of the percentage of unsaponifiable organic matter, of the Koettstorfer and acid figures, and of the amounts of insoluble bromine derivatives, and of the volatile oils, turpentine, and benzene. The following figures were found: Specific gravity at 15.5°, 0.931–0.937 (0.931–0.950 boiled oil); bromine addition figure, 100–110; bromine substitution figure, 3–5; iodine addition figure, 178–185; per cent. unsap. org. matter, 1.1–2.5; Koettstorfer figure, 186–196; acid figure, 3.0–7.0. In addition to these there is a correction table for temperature in determining the gravity of linseed oil by the hydrometer, and analytical data are given on the adulterants of linseed oil, such as rosin, menhaden, corn, and cottonseed oils, as well as upon genuine and adulterated oils. The report bears evidence of careful preparation and should be in the hands of every one interested in the subject.

Investigation of the Halphin Color Test as to Its Value for the Detection of Cottonseed Oil. By R. D. Oilar. *Am. Chem. J.*, 24, 355–373.—The work corroborates to a great extent that of other investigators who have used the test. It is found that old and rancid fats do not produce the reaction, which is not the case with the Bechi test. His method of procedure is as follows: Measure 10 cc. of pure amyl alcohol, pure carbon disulphide containing 1–2 per cent. fresh flowers of sulphur, and 10 cc. of the oil or melted fat into a large test-tube; heat in a water-bath until the violent boiling ceases, and finally in a salt-bath to a temperature of 105°–110° for forty-five to sixty minutes, or for two or three hours, if traces are to be detected. It is found that the test is given by none of the common edible oils and fats other than cottonseed; it is reliable with $\frac{1}{2}$ or $\frac{1}{4}$ per cent., and $\frac{1}{10}$ or even $\frac{1}{16}$ per cent. may be detected by it when compared with a blank test. It is so delicate that other oils which have been pressed in cottonseed presses will give the reaction. It can be applied to the soap or fatty acids as well as to the oil itself; it may serve also for the recognition of free sulphur. Tables are given, showing the results in detail.

G. W. Rolfe, Reviewer.

Rotation of the Plane of Polarization by Mixtures. By W. Porter Beck. *Am. J. Pharm.*, 73, 367–373.—The author describes polariscopic measurements of sugars and oils made to determine the principles governing the optical rotation of mixtures of optically active substances. The results confirm the law that in a physical mixture of optically active substances these preserve their rotating properties independently of each other.

Digitized by Google

ASSAYING.

H. O. HOFMAN, REVIEWER.

A Device for Sampling Pig Iron. BY P. W. SHIMER. *Trans. Am. Inst. Min. Eng.*, **30**, 321–323.—The device consists of a conveniently arranged breast-drill with a ¼-inch twist bit to bore the holes, and a cup to catch the drillings.

Power Laboratory Ore Grinder. BY C. B. MURRAY. *J. Am. Chem. Soc.*, **23**, 198–199.—This mechanical grinding apparatus, of which the note is an illustrated description, is used at the Edgar Thomson Steel Works. It resembles the well established Morrel agate mortar.

Notes on Some Blowpipe Tests. BY J. W. RICHARDS. *J. Am. Chem. Soc.*, **23**, 213–215.—The author gives details of manipulation in the use of the blowpipe for preliminary tests which insure accurate results. The blowpipe, which is used so little in testing, gives reliable and quick results when in the hands of an expert.

The Use of Metallic Sodium in Blowpipe Analysis. BY C. L. PARSONS. *J. Am. Chem. Soc.*, **23**, 159–161.—Referring to Hempel's method of using sodium as a reducing agent, the author prefers the following simpler manner of operating: a piece of sodium, 3 to 4 mm. in diameter, is flattened out, the powdered substance to be tested pressed into it with the hammer, the whole turned over with the blade of a knife, kneaded into a ball, placed upon a cavity in the charcoal and ignited, when with a flash the reduction takes place momentarily. The reductions are perfect.

The Measurement of Gold and Silver Buttons in Quantitative Blowpipe Assays. BY J. W. RICHARDS. *J. Am. Chem. Soc.*, **23**, 203–212.—The author briefly outlines Harkort's invention of the quantitative blowpipe assay for silver and gold, criticizes Plattner's improvements, describes the Goldschmidt modification (remelting the button on charcoal and measuring its horizontal diameter with a microscope) and gives full details of his own method in which he adopts Goldschmidt's idea of remelting the button, whenever practicable, and measures the button by a modification of Harkort's scale.

Experiments Regarding the Influence of Silica on the Loss of Silver in Scorification. BY L. STRAUSS. *Trans. Am. Inst. Min. Eng.*, **30**, 554–559.—In the work pure pyrite, zinc blende, galena, stibnite, and sulphur furnished the ores, silica and test-lead the fluxes (all were free from silver). The ores were charged with filings of silver, 0.992 fine and free from iron, and varying amounts of silica, scorified and cupelled. The results give numerical data for the known facts that the greater the amount of

Digitized by Google

the slag, the greater the loss in silver, and that the behavior of metallic sulphides is not uniform.

The Assay of Copper Materials for Gold and Silver. By L. D. GODSHALL. *Trans. Am. Inst. Min. Eng.*, 30, 529–531.—The author briefly reviews the usual dry and combined dry and wet methods for assaying coppery material, and proposes the following which he deems to be more satisfactory as to results and quicker: Dissolve 0.5–0.4 A. T. ore in dilute nitric acid, using small quantities at a time, add some sulphuric acid, evaporate excess of nitric acid, cool, add cool, then hot water, and introduce hydrogen sulphide for a few minutes until all the silver with only a little copper has separated out as a flocculent precipitate which carries down all the gold and is easily filtered; now filter, and proceed in the usual way by burning filter and assaying the ashes. The filtrate must be tested for silver with a pinch of salt or a drop of hydrochloric acid. Ledoux and Whitehead discuss the paper. Ledoux (page 1122) gives the following method as being in use at present in his laboratory; Dissolve one A. T. in dilute nitric acid, boil, filter, add to filtrate sufficient salt solution to precipitate all the silver as chloride, allow to stand over night (when pressed for time, stir vigorously by hand or better by compressed air), filter, scorify silver chloride, gold and insoluble residue together, cupel, etc. With some copper materials very low in gold the "all-fire method" is more satisfactory, as gold seems to go into solution. In this method ten samples of 1/10 assay-ton each are scorified with lead until most of the copper has been removed, then united, cupelled, etc. The author tested Godshall's method comparing it with the "combination" and "all-fire" method. He obtained the following results:

SILVER—OUNCES PER TON.

	Godshall method.	Combination method.
No. 1	67.70	67.20
" 2	57.20	58.80
" 3	59.00	59.30

GOLD—OUNCES PER TON.

		"All-fire" method.
No. 1	2.28	2.42
" 2	1.89	2.10
" 3	2.06	2.18

The Godshall method seems to show a high silver and a low gold result. Whitehead (page 1124) says that his experiments with coppery material have proved that some gold was liable to go into solution when treated with even chemically pure nitric acid. He therefore welcomes the Godshall method. His experience with it shows that excellent results are obtained if the solution is cold and practically free from nitric acid. In order to do

Digitized by Google

away with the tedious elimination of nitric acid by evaporation with sulphuric acid, he dilutes the nitric acid solution, makes it faintly alkaline with ammonia, and reacidifies with acetic acid, then adds enough sodium hyposulphite to precipitate 100 mgms. of copper, stirs, boils for five minutes or until the cuprous sulphide collects, filters, scorifies, cupels, etc.

The Colorimetric Assay of Copper. By J. D. A. Smith. *Trans. Am. Inst. Min. Eng.*, 30, 851–854; discussion by G. L. Heath, 1119–1121.—Referring to the apparatus described by Heath (*J. Am. Chem. Soc.*, 19, 24) for carrying out the Heine colorimetric assay of copper, the author prefers to do away with preserved sets of standard colors and to make a fresh standard for each batch of assays. The paper describes the method in detail and gives a table of results. Heath defends the use of standards.

INDUSTRIAL CHEMISTRY.

F. H. Thorp, Reviewer.

A Proposed Method for the Extraction of Bromine. By Anson G. Betts. *Eng. Min. J.*, 71, 783.—Analyses of brines from Midland and Sand Beach, Michigan, and Syracuse, New York, are given, and also the percentage of bromine in the North Atlantic Ocean (0.00635) and in the Dead Sea (0.443). The method proposed is based on the reaction between bromine and phenol, in aqueous solution by which tribromphenol and hydrobromic acid are formed. The bromine must be free and is liberated by the action of chlorine water, but no free chlorine should be present, when the phenol solution is added. The chlorine water and carbolic acid are added three times to precipitate 87.5 per cent. of the total bromine. The reaction takes place instantly, and at ordinary temperatures a precipitate of the tribromphenol appears, if the brine contains as much as 0.002 per cent. of bromine. It was found impossible to precipitate all of the bromine and form hydrochloric acid. Electrolysis is suggested as an advantageous method of setting free bromine; at 5 volts, one horsepower is equivalent to ⅔ lb. of bromine precipitated. If the phenol is pure the precipitate is crystalline and filters easily; if cresole is present, the precipitate is tarry. By drying and heating the precipitate, most of the bromine is recovered as hydrobromic acid; the rest is caught by passing the vapors through an alkali solution, or a solution of ferrous bromide. Reduction of the precipitate by iron and mineral acid will regenerate the phenol, according to the reaction

$$2C_6H_2Br_3(OH) + 3H_2SO_4 + 6Fe = 3FeSO_4 + 3FeBr_2 + 2C_6H_5OH.$$

The process is best carried on by saturating one part of the brine with chlorine and another part with phenol, and then mixing the two portions. Other organic bodies, such as acetylene, are suggested as suitable for recovering bromine from brine.

Digitized by Google

Soil Analyses. *Bull. No. 38, N. M. Agr. Expt. Sta. Bull. No. 47, N. D. Agr. Expt. Sta.*

Researches on Nitrocellulose. By G. LUNGE. *J. Am. Chem. Soc.*, **23**, 527–579.—This is a long and very complete paper, dealing chiefly with the methods of analysis and the methods of obtaining the various nitrocelluloses. Several illustrations of analytical apparatus are given.

Modern Production of Alum and Aluminium. By J. OHLY. *Min. and Metal.*, **24**, 403–404.—After giving a historical review of the development of the aluminium industry, the author describes a recent French process for purifying bauxite by heating with alkaline sulphides. The iron is converted into ferrous sulphide, but the heat is not sufficient to form aluminates. The fused mass is treated with some sulphuric acid under such conditions that the solution is kept strongly alkaline, while sodium aluminum sulphate is formed and crystallized. The preparation of aluminum hydroxide from this salt is also described. The uses of aluminum as conductors and reducing agent are then considered.

A. H. GILL, REVIEWER.

On Fluctuations in the Composition of Natural Gas. By F. C. PHILLIPS. *Proc. Am. Acad.*, **34**, 71–83.—The paper describes an apparatus for the combustion of the gas, samples of from 150–400 cc. being employed, and for the determination of nitrogen in the gas. The per cent. was found to vary from 1.2–3.2 in the same well. No oxygen was found in it. It is possible that the gas occurs liquefied in the rocks, and that the nitrogen is gradually distilled off from it. Attention is called to the fact that it is not easy to prepare from marble, carbon dioxide free from nitrogen. This can be effected with certain marbles, only by boiling them with water for six hours and then transferring them to the generator.

On the Composition of California Petroleum. By C. F. MABERY AND E. J. HUDSON. *Am. Chem. J.*, **25**, 253–284.—Eight different samples, representing a fair average of the California oils, were examined: a preliminary distillation showed that they could not be distilled without decomposition except *in vacuo* and here the process could be continued to 350° at 50 mm. Analysis showed their chief constituents to be methylenes. All the samples were submitted to fractional distillation *in vacuo*, it being repeated in some cases twenty-four times. The results of the examination of the distillates boiling up to 216° are shown in the table below:

Digitized by Google

Fresno Co.	Puente.	Bardsdale.
.....	sp. gr. 20° 0.892	sp. gr. 20° 0.892
.....	% S 0.8	% S 1.5
.....	% N 1.2	% N 1.25
Hexane?	.....	.....
Nonane	.....	.....
Hexamethylene	.....	.....
Heptamethylene	Heptamethylene	Heptamethylene
Octonaphthene	Octonaphthene	Octonaphthene
Nononaphthene	.....	.....
Dekanaphthene	Dekanaphthene	Dekanaphthene
Undekanaphthene	.....	Undekanaphthene
Dodekanaphthene	.....	.....
Benzene	Homologues of	.....
Toluene	benzene	.....
Xylenes	$C_n H_{2n-2}$ series?	Xylenes

Adams Canon.	Torrey wells.	Scott's Hill.
sp. gr. 30° 0.921	sp. gr. 20° 0.884	sp. gr. 20° 0.878
% S 0.9	% S 0.5	% S 0.4
% N 1.46	% N 1.15	% N 1.25
.....	Hexane?	Hexane?
.....	Nonane	.....
.....	Hexamethylene	Hexamethylene
Heptamethylene	Heptamethylene	Heptamethylene
Octonaphthene	Octonaphthene	Octonaphthene
.....	.....	.....
Dekanaphthene	Dekanaphthene	Dekanaphthene
.....	.....	Undekanaphthene
.....	.....	.....
Homologues	.....	.....
of benzene	Toluene	.....

Tri-, tetra-, and pentadekanaphthenes were identified in some of the higher boiling portions. California petroleum contains then a small portion of products boiling below 225° which resemble those in Russian oil; the proportion of aromatic hydrocarbons is, however, larger. It contains only small quantities of substances of the C_nH_{2n+2} series.

On the Composition of Japanese Petroleum. By C. F. Mabery and S. Takano. *Am. Chem. J.*, 25, 297–307.—The results show that Japanese petroleum is mainly composed of the methylene hydrocarbons. Some contain also solid paraffins and in some the percentage of sulphur and nitrogen is as high as in the California oils.

Composition of Texas Petroleum. By C. F. Mabery. *J. Am. Chem. Soc.*, 23, 264–267.—The paper gives the analysis of oil from the Lucas gusher. This has a strong odor of hydrogen sulphide, contains 2.16 per cent. of sulphur, and 1 per cent. of nitrogen, and has a specific gravity of 0.92. It seems to contain $C_{14}H_{26}$ and $C_{16}H_{30}$, compounds having perhaps a double polymethylene ring.

Digitized by Google

G. W. ROLFE, REVIEWER.

Sugar Beet Investigations in Ohio in 1900. BY A. D. SELBY AND J. W. AMES. *Bull. Ohio Agr. Expt. Sta.*, **126**, 133–174.—This bulletin contains detailed results of an investigation of sugar-beets grown in Ohio and a popular description of Ohio's first factory recently built at Fremont.

Sugar Beets, 1891-1900. *Bull. Expt. Sta. Kans. State Agr. Coll.*, **103**, 253–286.—Tabulated statements of investigations on sugar-beet cultivation are presented, which show that Kansas is unsuited for beet-sugar production.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

Improvements in the Metallurgy of Aluminum. BY C. P. TOWNSEND. *Elec. World and Eng.*, **38**, 14–15.—The improvement described refers to two patents (June 25, 1901), by C. M. Hall of an electric fusion method for purifying bauxite. Bauxite, *e. g.*, with alumina, 60 per cent.; ferric oxide, 18 per cent.; silica, 2–3 per cent.; titanic oxide, 3–4 per cent. and water 17 per cent., is calcined, mixed with 8 to 10 per cent. of carbon, held for about one hour in fusion in an electrical furnace having a carbon lining and a carbon electrode; the current can be alternating or direct. Only the impurities are reduced; they collect on the bottom of the bath as a fused alloy, especially in the presence of considerable amounts of iron. In the second method, metallic aluminum or a 50 per cent. ferro-aluminum is substituted wholly or in part for the carbon, to combine with the oxygen of the silica, titanic, and iron oxides; the charge is maintained in fusion for one and one-half hours in the electric furnace, when the impurities will again have separated out. As in this case there is little or no evolution of gas, the fusion is less disturbed than when carbon is used. The elimination of silicon and iron are satisfactory; less so, is that of titanium. The purified alumina differs from that produced by the usual combined dry and wet methods. It is grayish-white, crystalline, has a specific gravity of 3.70 to 3.93, resembles in structure coarse-grained sandstone that is easily crushed, and often friable between the fingers. The product is partly soluble in hydrochloric acid and caustic alkalies with liberation of methane and hydrogen, the former is due probably to aluminum carbide, the latter to the partial reduction of Al_2O_3 to Al_3O_4 or Al_2O.

Discussion of Paper of Mr. Scherr on Reduction Roasting. Its Value for Arsenic Expulsion from Copper Ores and Mattes. BY H. M. HOWE. *School Mines Quart.*, **22**, 381–382.—In his paper (*this Rev.*, **6**, 431) Mr. Scherr held (1) that a metallic ar-

Digitized by Google

senate in roasting was decomposed by the joint action of sulphuric anhydride and a weak reducing agent, like sulphur, iron, or copper, the former decomposing the arsenate and the latter reducing the stable arsenic oxide to the volatile arsenious oxide; and (2) that the presence of a powerful deoxidizing agent like charcoal was liable to reduce the sulphuric anhydride and prevent its decomposing metallic arsenate. The author suggests that the reason why the arsenic was not wholly expelled toward the end of the roast was perhaps due to the fact that the ore was not ground sufficiently finely for the sulphuric anhydride to reach the centers of the particles of ore.

Further Notes on Elimination of Impurities from Copper in Refining and Converting. By E. KELLER. *Trans. Am. Inst. Min. Eng.*, 30, 310–314.—In order to approximate as much as possible the slaggability of impurities in refining copper, the author (neglecting the small amounts eliminated by volatilization) adds the impurities in the refined copper to those in the slag and calculates the amounts slagged as percentages of that sum, referring the whole to the unit copper. His figures for the relative slaggability are in per cent.; Cu, 1; Pb, 52.1; Bi, 1.07; Sb, 5.90; As, 5.07; Se, Te, 0.84. Samples of matte and converter-copper from the five blows made at Copper Queen mine show a percentage elimination of: Se, 46.8; Te, 40.0; Ni, 37.0; and Co, 100.

Making Sand Castings of Copper. By C. VICKERS. *Iron Trade Rev.*, *1901*, 34, 17.—When copper is being melted down in a crucible, it absorbs gases and some copper is liable to be oxidized even if the surface be covered with charcoal. The gas makes the copper porous, and the cuprous oxide formed and taken up by the copper makes it brittle. Quite a number of methods have been suggested to diminish the absorption of gas and aid the deoxidation of cuprous oxide. The author gives some details of these.

The Properties of Brass Made from Copper Containing Sub-Oxide, with Observations of the Effect of Oxygen on Copper. By E. S. SPERRY. *Trans. Am. Inst. Min. Eng.*, 30, 837–850.—In poling copper, the reduction of cuprous oxide is not completed in order that traces of bismuth, arsenic, and antimony in the copper shall be present as oxides when they are less harmful than when as metals. Small amounts of cuprous oxide are liable to make copper somewhat cold-short, but not hot-short, hence the metal is rough-rolled hot and finished cold. In making brass, some of the zinc is oxidized at the expense of the metallic oxides contained in the copper. In the experiments made to see what effect the oxygen of the copper had in brass-making, the copper used was oxidized by exposing it when melted to air; analyses gave from 1.12 to 1.52 per cent. oxygen. Oxidation with niter proved

Digitized by Google

unsuccessful. The base-composition of the brass used was copper 60 per cent. and zinc 40 per cent. The experiments show that the amounts of oxygen usually contained in commercial copper (0.010 to 0.012 per cent.) have no harmful effect on the quality of brass intended for rolling into sheets, the oxygen may reach even 0.55 per cent. and does no harm if special care be taken. An excessive amount of oxygen causes the formation of a salamander, a mixture of infusible zinc oxide and copper. If oxygen is present in not sufficient amount to form a salamander, but above 0.55 per cent., the brass will show a tendency to crack, due to the presence of zinc oxide.

Note on the Plate-Amalgamation of Gold and Silver. By E. A. H. Tays. *Trans. Am. Inst. Min. Eng.*, 30, 318–320.—In a former paper (*Trans.*, 29, 776); the author gave some data on the milling of silver-bearing gold ore of the Anglo-Mexican Gold Mining Company, San José de Gracia, Sinaloa, Mexico, in the Bryan roller quartz-mill. He now supplements them by figures obtained from the same kind of ore with the stamp battery. The ore stamped assayed gold 0.76 oz. and silver 0.71 oz., the tailings 0.22 and 0.27 oz. per ton, showing an extraction of 0.54 and 0.27 oz. or 71.7 and 39.4 per cent. Based on the assays, the extraction should be 2 : 1 ; the average fineness of the bullion, however, gave a ratio of 2.74 : 1. In the Bryan mill the ratio of gold to silver recovered was 2.34 : 1.

Gold Ores in the Black Hills, South Dakota. By H. M. Chance. *Trans. Am. Inst. Min. Eng.*, 30, 278–285.—The silicious gold-belt in the vicinity of Deadwood and Lead City covers an area 6–7 miles in length and 3–4 miles in width, and is 300–400 feet thick. It has ore-chutes and ore-horizons scattered through it which give an average value of $12.00–$18.00 per ton. The ore is mined at a cost of not over $4.00 per ton ; it is treated by raw- and pyritic-smelting at a cost of $4.75–$5.75 per ton, by barrel-chlorination for $3.50–$4.50 per ton, and by cyaniding for $3.00–$3.75 per ton. The second class of deposit comprises the free milling ores occurring as steep veins in metamorphosed rocks ; the bulk of the gold is extracted by battery amalgamation, the rest by concentrating the tailings and leaching with potassium cyanide.

Pyritic Smelting in the Black Hills. By F. R. Carpenter. *Trans. Am. Inst. Min. Eng.*, 30, 764–778, 1128.—The author uses the term pyritic smelting in the same manner as Percy; *viz.*, smelting dry silver-ores in connection with iron pyrites to form a matte. He places on record his successful work in smelting the ores of the silicious gold-beltnear Deadwood, South Dakota. In his practice he followed in general the work of Mansfeld, Germany, in that he made slags ranging between 4RO, $3SiO_2$ and

Digitized by Google

RO, SiO_2—RO being mainly lime and magnesia, FeO playing a minor rôle. The matte-fall rarely exceeded 5 per cent. Iron sows formed in the operation, and these helped to carry down the gold, so that clean slags could be made in the absence of copper which has always been considered essential if waste slag free from precious metal is to be produced. The refining of the matte was at first accomplished by treating with lead ores; here it was found that matte as well as iron sows readily gave up their gold to the lead, while the extraction with silver was not so perfect. A second method outlined by the author is to smelt the matte for copper bottoms which, being granulated, oxidized and resmelted with sulphur-bearing material, would give a second bottom very much richer than the first. In order to have a perfect concentration it is essential that some lead is present. The bottom from the second selecting is so rich in lead that it can be cupelled, often directly without the addition of lead, six parts lead to one of copper giving satisfactory results. The first bottoms can be smelted directly with sulphur-bearing material without granulating and oxidizing, and the operation repeated until the concentration has reached the desired degree.

Furman (*op. cit.*, 1125), in discussing the paper, states that he believes that alumina always ought to be figured as replacing silica and gives some experience of his in smelting peculiar lead ores, when he found the most suitable slag to be SiO_2, 28; Fe(Mn)O, 36; CaO, 16; and Al_2O_3, 14 per cent. He further attacks the practice of making iron sows and suggests that the addition of pyritic and coppery material would have obviated it.

Carpenter defends his practice and gives new evidence of its correctness by citing the leading facts of the work he did along similar lines in Colorado in smelting Cripple Creek ores. He shows how important it is to distinguish between formation temperature and fluidity of slag, the former having proved in his first work in Colorado to have been so low that the slag would not run. As to Furman's suggestion of adding sulphurous material to the charges to prevent the formation of sows, the author shows how it is that this would, on the contrary, have aggravated the trouble.

The Union Gold Extraction Company's Mill at Florence, Colorado. By J. E. Rothwell. *Eng. Min. J.*, 71, 721–724.—In this mill, which has a capacity of 400 tons ore per day and is built to do custom work, the gold from Cripple Creek is extracted by means of barrel-chlorination. The mill is described under the following heads: Sampling, storage and purchase of the ore; drying and fine-crushing; roasting and cooling; chlorination and precipitation; roasting, melting and refining; concentration, power plant and water supply system; assay office, laboratory. For details the reader is referred to the original.

Digitized by Google

Chlorination Mills at Cripple Creek, Colorado. The Methods Used in Handling the Ore and the Application of the Process. By A. LAKES. *Mines and Minerals*, **21**, 337–339.—This article is a general one with some good photographic reproductions; some details are given of the Economic Chlorination Mill.

Cyaniding Stamp Mill Tailings in Western America. A Description of the Dexter Gold Mining Company's Plant at Tuscarora, Nev. By W. MAGENAU. *Mines and Minerals*, **21**, 299–301.—The plant treats the tailings from the forty-stamp mill which crushes daily 102 tons silicious ore containing 85 per cent. silica, and 10 per cent. iron. On account of clayey seams in the ore as much as 5 gallons of water per stamp per minute is required in stamping. The mill tailings are raised by a bucket elevator and run into three iron settlers (12 feet deep and 18 feet in diameter), supplied with Butters and Mein automatic revolving distributors. Fifty-two tons of sands ($1.57 gold and $1.70 silver per ton) are separated per day from slimes ($3.19 gold and $5.03 silver per ton) which overflow into an annular trough and are collected in two artificial ponds. The bottom of a settler has a gravel filter and two 18-inch discharge-holes closed with hollow sheet iron plugs. One settler is being filled while the second is drained and the third emptied. Draining is accomplished on the inner side by a vertical box (10 × 4 inches and 12 feet long closed on one side with old battery screens) and on the bottom by four drainage pipes. A settler catches 51 per cent. of the material fed into it. The sands are discharged into cars beneath by shoveling and trammed to the leaching department. This contains 14 tanks (10 of 20, and 4 of 50 tons' capacity). The filter is a false bottom of 1-inch boards with $\frac{3}{8}$-inch holes, it rests on slats, 1 × 1 inch placed 8 inches apart, and is covered with 10-oz. canvas. The method of leaching is that of continuous percolation, a stream $\frac{1}{2}$ inch in diameter flowing from the 2-inch discharge pipe. The cyanide consumed, $1\frac{1}{2}$ lbs. per ton treated, is replaced by feeding the necessary amount into a perforated tin box, resting on the top of a newly-charged tank, and allowing the fresh solution to play upon it in such a way that all the cyanide will be dissolved when the ore is submerged. The ore is leached in from three to five days and receives one wash-water (1 ton water to 4 tons ore) after the solution has been drained off. The leached tailings are sluiced out by water passing through a 2-inch hose with $\frac{1}{2}$-inch nozzle under a pressure of 60 pounds; one man sluices out 50 tons in $1\frac{1}{2}$ hours.

The gold is precipitated in ten rows of boxes, each having ten compartments 12″ × 12″ × 10″. The solution, flowing at a rate of 3.1 tons per hour, contains when entering 0.97 oz. silver and 0.082 oz. gold per ton, and when leaving 0.10 oz. silver and 0.01 oz. gold which represents a saving of 88.7 per cent. The dried

Digitized by Google

precipitate (containing gold 3.31 per cent., silver 70.16 per cent., zinc 9.76 per cent., iron 1.45 per cent., lead 1.40 per cent., silica 6.48 per cent., n. d. 7.44 per cent.) is sold to lead smelters. The solution when titrated with silver nitrate without an indicator gives 4 lbs. potassium cyanide per ton; its alkalinity is equivalent to 0.16 per cent. H_2SO_4. The slimes of a pond, when filled, are allowed to dry. When the upper two or three feet have become well baked in the arid climate they are removed, brought to the leaching mill and charged with alternate layers of sands into the leaching vats and worked in the same way as the sands. The average extraction is 66.8 per cent. gold and 37.7 per cent. silver or 51.7 per cent. of the total values. The labor required is one foreman, one car-man, two shovelers, one night solution-tender, the foreman doing this work during the day.

Cyaniding Cupriferous Ores. By L. Janin. *Eng. Min. J.*, 72, 197.—The oxidized gold ores of the Lydenburg district, Transvaal, are composed of quartz, oxides of iron, dolomite and contain besides the gold, small quantities of manganese, bismuth, silica, and copper. In the cyanide treatment manganese dissolves only when an insufficient amount of lime is used, bismuth presents no difficulties, 10 per cent. silver or less is recovered. The copper of the ore amounts to 0.4 per cent. and is present in different forms, metallic copper collecting on the amalgamating plates and of the rest only a small portion being dissolved by the cyanide, forming potassium cuprocyanide, 3KCy,CuCy. The only method of removing the copper was to treat the ore with the cyanide solution obtained in ordinary practice containing cuprocyanide, but no free cyanide. This solution would dissolve the copper and, after having been freed from it again by the Siemens-Halske electrolytic method of precipitating, would be used over again.

The Quicksilver Mines of Brewster County, Texas. By E. P. Spalding. *Eng. Min. J.*, 71, 749–750.—The only company in this promising district, described in detail, that is treating the cinnabar ores, is the Marfa and Mariposa Mining Company. It has in operation a 10-ton Hüttner-Scott furnace. The ore, crushed to ½-inch, is charged hourly by a car holding 900 lbs. and every half-hour half a car of spent ore is withdrawn below. It takes the ore about twenty-four hours to pass through the furnace in which time from 1¼–1½ cords of wood are burned on the grate. The fumes leaving the furnace through a 16-inch sheet-iron pipe zigzag through six condensers, each with a partition wall, before they pass through a long flue into the air. The condensers are dry on account of the scarcity of water. Most of the quicksilver collects in the first three chambers which are freed from soot weekly, while the others have to be cleaned up only once a month. The condensed quicksilver runs off continuously into a storage tank to be bottled. The soot is freed from a large

Digitized by Google

part of its quicksilver by working on an inclined plane, when it is added in small amounts to the ore charge. The yield in quicksilver is estimated to be 90 per cent. In five months 1200 flasks of quicksilver were produced.

Blast-Furnace Gases in Gas-Engines. By J. W. RICHARDS. *J. Franklin Inst.*, **150**, 415-430; *Iron Trade Rev.*, **33**, Dec. 13, 20, 1900.—The author briefly reviews the beginnings and the present use of iron blast-furnace gases in gas-engines. He then calculates from three examples of gas—poor, average and rich—the surplus horse-power that can be obtained if the gases are burned directly in gas-engines or first under boilers to drive steam-engines, and shows what great advantages the former have over the latter.

The Protection of Blast-Furnace Linings. By S. S. HARTRANFT. *Trans. Am. Inst. Min. Eng.*, **30**, 573–577.—While furnacemen take the necessary precautions to protect the hearth and bosh of an iron blast-furnace beyond the life of the lining of the shaft, the portion of the lining above the mantle-plate has been more or less neglected. The author proposes to secure this part by introducing water-cooled plates which shall reach with their front edges to within from 9 to 12 inches from the inside of the brickwork. This will permit an enlargement of diameter of from 18 to 20 inches without endangering the plates and a longer blast of regular work than is the case now.

A Peculiar Silicious Efflorescence upon Pig Iron. By B. F. FACKENTHAL. *Trans. Am. Inst. Min. Eng.*, **30**, 524–528.—At Durham furnace, while making Bessemer iron low in silicon, it was found that when the pigs were broken hot from the sow an efflorescence was found to exude from the fractures in the form of small globules and thin sheets. An analysis of the efflorescence gave the following figures:

	Per cent.	Per cent.
Silica	94.87	97.67
Oxide of iron	0.98	1.01
Oxide of manganese	0.25	0.26
Lime	None	None
Magnesia	None	None
Titanic acid	0.95	0.98
Loss on ignition	2.87	....
Total	99.92	99.92

The loss by ignition in the second analysis is principally graphite. A microscopic examination showed the material to have a radial fibrous structure, besides there were found occasional cubical crystals of titanium carbide and some minute hexagonal crystals believed to be graphite. The paper gives the details of the blast-furnace working at that period and an analysis of cadmia that had formed.

Digitized by Google

Howe (*op. cit.*, 118), in discussing the paper, believes the silicious efflorescence may have been due to the eliquation of a zinc or lead silicide which, held in solution by the cast iron in the blast-furnace, would upon removal of the gas or vapor-pressure of the furnace quickly be volatilized and at the same time oxidized.

The Foundry of the General Electric Company at Schenectady, N. Y. By C. L. Prince. *J. Am. Foundrymen's Assoc.*, 9, (1), 83–95.—An illustrated description, rather general in its character.

Shot Iron, How to Recover It, and How to Use It. By C. H. Putnam. *J. Am. Foundrymen's Assoc.*, 9, (1) 101–104, (2) 71–75, (3) 15–16.—In well-equipped foundries the cinder from the cupola is usually crushed in a tumbler and the shot separated from the pulverized cinder. The author goes farther in that he passes the pulverized cinder over a magnetic separator and thus saves additional iron; he recovers daily from the dump of two cupolas 550 lbs. siftings which give 450 lbs. strongly mottled iron after melting. This iron has got to be worked in with the regular cupola charge, the amounts to be found by experiment. The daily saving by the combined crushing and magnetic separation with two cupolas amount to $3.00.

Anthracite as a Cupola Fuel. By E. Kirk. *The Foundry*, 18, 111–114.—The use of anthracite as a cupola fuel is limited on account of the smallness of the anthracite fields, the leading ones occurring in four counties of eastern Pennsylvania. While in this region formerly anthracite was the sole cupola fuel, it has been greatly superseded by coke, a mixture of the two giving most satisfactory results. The paper contains tables giving the complete records of a number of foundings using anthracite and mixed anthracite and coke.

The Grading of Casting. Report by Thos. D. West and R. Moldenke. *J. Am. Foundrymen's Assoc.*, June, 1901.—The authors suggest that, in grading, the percentages of silicon and sulphur should show the following range:

	Per cent.	Per cent.
No. 1	2.50 to 3.00	0.03 maximum or under.
No. 2x	2.00 to 2.50	0.03 " " "
No. 2 soft	2.50 to 3.00	0.04 " " "
No. 2 plain	2.00 to 2.50	0.05 " " "
No. 2 strong	1.50 to 2.00	0.05 " " "
No. 3	1.50 to 2.50	0.10 to 0.05
Etc.	Etc.	Etc.

Fracture Indicates Quality. By E. A. Mayne. *The Foundry*, 18, 123–124.—This note is the plea of a foundry man for the use of a little common sense in the judging of the quality of pig iron.

Digitized by Google

It appears that the earnest and just protest against judging pig iron by fracture is being used by unscrupulous people in palming off all sorts of stuff on the foundrymen on the strength of a so-called chemical analysis.

Foundry Iron. By C. Henning. *J. Am. Foundrymen's Assoc.*, 9 (1), 121–124.—The author attributes most of the difficulties encountered by foundrymen to the variation in the composition of the pig iron. He has always had successful casts with iron having the following range of composition: total carbon, 3.50–3.75; combined carbon, 0.27–0.52; Si, 2.62–3.22; Mn, 0.98–1.18; P, 0.60; S, 0.03; Cu, 0.02; that is, the impurities ranged from 7.50–8.10 per cent., and the iron did not run lower than 92.475 per cent. Whenever the amount of impurities exceeded 8 per cent. or a determination gave a lower figure for iron than 92 per cent., the castings would be porous and weak.

The Influence of Silicon and Sulphur on the Condition of Carbon in Cast Iron. By H. M. Howe. *Trans. Am. Inst. Min. Eng.*, 30, 719–733.—In recent publications data have been given which seem to show that the percentage of graphite in cast iron is independent of the amount of silicon present. The author attributes this belief to a wrong interpretation of the evidence. He shows that the graphite-content in normal and relatively pure commercial pig iron is influenced only indirectly by the percentage of silicon, in that silicon lowers the solvent power of iron for carbon, and thus lessens the proportion of combined carbon and increases that of graphite, provided the total carbon remains constant; the decrease of combined carbon is rapid at first, especially as the silicon rises from zero to 0.75 per cent., and then slower and slower; the influence of silicon is often masked by that of other variables. Sulphur is known to raise the saturation point of cast iron for carbon; by increasing the combined carbon-content, it lowers the graphite-content. It is estimated that the proportion of combined carbon in pig iron is increased 0.02 per cent. for each 0.01 per cent. increase in sulphur when the iron contains 1–2 per cent. Si, and 0.03 per cent. for each 0.01 per cent. S, when the iron contains 2–3 per cent. Si.

The Microstructure and Physical Properties of Cast Iron, as Affected by Heat Treatment, Especially in the Manufacture of Malleable Cast Iron. By A. T. Child and W. P. Heineken. *Trans. Am. Inst. Min. Eng.*, 30, 734–759.—In the experiments, of which the paper is a record, white and gray cast iron bars 0.5 inch thick, and 18 inches long were packed in iron oxide and annealed for from ten to forty days at a temperature of about 950° C. Microphotographs and tension tests of the original and the annealed bars show the changes which take place in the process. In general, the cement carbon of a bar breaks down in the

Digitized by Google

process to temper carbon; this is oxidized, while the graphite is only very slowly attacked, hence the original cast iron must contain much cement carbon, that is, it must run low in silicon. If the casting is high in silicon, there remains much graphite; such an iron requires a very long time for annealing, and gives, being imperfect, a weak porous product. The details of the experiments can be discussed only in connection with the micrographs (of which there are 30), the cooling curves (13 in number), and the table of mechanical tests.

The Chemistry and Physics of Cast Iron. A continued discusssion by H. M. HOWE, OUTERBRIDGE, W. R. WEBSTER, AND A. W. WHITNEY. *J. Franklin Inst.*, **150**, 329–355.—Excellent reproductions of fractures of castings accompany the discussion.

The Annealing of White Cast Iron. BY C. JAMES. *J. Franklin Inst.*, **150**, 227–234; *Foundry*, **17**, 270–274.—The author, who is a manufacturer of malleable castings, has embodied in this paper some leading facts relating to the chemistry of annealing. Only Bessemer pig iron is used at his works; the furnace charges consist of mixtures of gray irons (combined carbon, 0.50; graphitic carbon, 3.50; Si, 1.30; Mn, 0.30; S, 0.02; P, 0.08), and of scrap from previous operations, the whole being made up to contain: C, 3.40–3.80; Si, 0.90–1.20; Mn, 0.35–0.20; S, 0.05–0.04; P, 0.04–0.03. The charges are melted occasionally in the cupola, but generally in a reverberatory furnace holding from 3 to 5 tons of metal. A furnace is brought to nearly the melting-point of the iron before it is charged. This will cause the iron to melt down in from three and a quarter to three and three-quarters of an hour; it is then rabbled and fined for from thirty to forty minutes, when a test-piece 8 inches long and 1¼ inches in diameter, rapidly cooled (when it has solidified) and broken, will show that apparently all the graphite has disappeared; the casting, made from the iron, will however show a little graphite which rarely exceeds 1.5 per cent., an average of a number of such castings giving: Combined carbon, 3.02; graphite carbon, 0.47; Si, 0.78; Mn, 0.12; S, 0.05; P, 0.04. The charges of the annealing furnace weigh from 2 to 3 tons, large castings are placed in the open furnace, small ones are packed in covered boxes of cast iron or wrought iron; the only difference between the two after annealing is that the former show more scale. The reason that castings when heated in the open furnace are not annealed more quickly than when packed, is that in the iron boxes annealing still goes on while the furnace is being cooled off, while, of course, this is not the case with open castings. The weight of the castings to be annealed shows a range of from 0.5 ounce to 2000 pounds; the time required varies accordingly from three and one-half to ten hours after the castings have attained the full temperature which

Digitized by Google

is about 1010° C. The temperatures at which change of carbon from the combined (cement carbon) to non-combined (temper carbon) state takes place varies somewhat with the composition of the iron and is closely related to its melting-point, and this again is governed by the relative amounts of carbon, silicon, manganese and sulphur. The following two analyses give the changes of the form of carbon in annealing.

Annealing.	Combined carbon.	Temper carbon.	Si.	Mn.	S.	P.
Before	2.60	0.72	0.71	0.110	0.045	0.039
After	0.82	2.75	0.73	0.108	0.04	0.039

As to the effect of impurities, the author finds that phosphorus has none, while the reverse holds good for silicon and manganese; investigations as to the influence of sulphur are still in progress. Irons low in silicon and manganese are practically worthless after annealing, as shown by the following analyses of annealed castings:

Combined carbon.	Temper carbon.	Si.	Mn.
2.65	none	0.46	trace
1.97	none	0.42	trace

Iron high in these two elements works well, *viz.*:

Annealing.	Combined carbon.	Temper carbon.	Si.	Mn.
Before	1.94	none	0.64	0.09
After	none	2.00	0.62	0.110

Thus, silicon forces the carbon to change its condition and manganese protects the silicon from oxidation.

The Cupola Practice in the Bessemer Steel Works. By S. M. Rogers. *J. Am. Foundrymen's Assoc.*, **9**, (1) 40–46.—The cupola of a Bessemer plant differs only in a few details from that of a foundry in that it has to run continuously for a longer period. Thus it is important that the crucible walls up to the boshes shall be not less than 24 to 26 inches thick; the tuyères are also placed higher than with the foundry cupola, as the crucible has to hold a larger amount of metal. The number and size of tuyères depends upon the size of the furnace; about 30,000 cubic feet of air are required to melt 1 ton of iron; a furnace with a 4-foot crucible and a 5-foot bosh will contain 48–50 tuyères in two rows, the tuyères being 4 inches in diameter on the outside and tapering to 2½ inches on the inside; the area of the tuyères should be at least 2½ times as great as that of the bustle-pipe. The pressure used shows a range of from 4 to 7 ounces per square inch; if the pressure be higher, iron is liable to be oxidized and the slag to foam. In order to flux the coke ash, adhering sand, etc., forming an acid slag, from 35 to 40 pounds of limestone are added per ton of iron. The cupola under favorable conditions will run continuously for a week; the life will

Digitized by Google

be shortened if the iron contains much manganese. In regular work it frequently happens that there is some delay in the converting; in such cases the work of the cupola has to be held back. If the delay lasts longer than six to eight hours, the contents of the cupola will have to be dropped.

Further Notes on the Bertrand-Thiel Process. By J. Hartshorne. *Trans. Am. Inst. Min. Eng.*, 30, 531–536.—Since the last report on this process by the author (*this Rev.*, 6, 56), the main development has been in the direction of using direct metal from the blast-furnace. The furnace has also been enlarged. The charge consists now of 80 per cent. liquid pig, 10 per cent. cold pig, 2 per cent. old rolls, 8 per cent. scrap, with about 93.6 per cent. iron; four heats are made per furnace per day, and the yield in clean ingots is 98.4 per cent. See also Howe (*The Mineral Industry*, 8, 378).

The "Talbot" Continuous Open-Hearth Process. By H. W. Lash. *Iron Trade Rev.*, 1901, 34, Feb. 28, p. 14. The paper discusses the production of steel by the Bessemer and the ordinary and the Talbot basic open-hearth processes. It appears that in due time the Bessemer will have to yieid to the basic open-hearth process which already now produces at the same cost a higher grade steel from a cheaper pig; its disadvantages are that it requires from five to six times the yard space of a Bessemer plant and delivers the steel with less regularity and in larger units. During the last six months the Talbot process, in operation at the Pencoyd Iron Works near Philadelphia, has produced regularly 107 tons steel and scrap for every 100 tons of pig charged, the large excess being due to the better reduction of iron from iron oxide charged and the better protection of the metal from oxidation. The paper gives a horizontal and vertical cross-section through a Talbot open-hearth plant with two 200-ton furnaces. With each cast 20 per cent. of refined metal is removed and replaced by 40 tons of unrefined metal either direct from a blast-furnace or a mixer. As 10 casts are made in twenty-four hours, the capacity of the plant is 400 tons steel per day. The relative costs of Bessemerizing and producing steel by the Talbot process are shown in the subjoined estimates:

Bessemer Process.

100 tons of pig iron at $12.00 per ton	$1,200.00
1 ton of ferromanganese at $60.00 per ton	60.00
	$1,260.00
Product 90 tons of ingots and scrap. Cost of raw material per ton of ingots produced	$ 14.00

Digitized by Google

TALBOT PROCESS.

110 tons of pig iron at $12.00 per ton	$1,200.00
30 tons of ore, mill cinder and scale, at $4 per ton	120.00
9 tons of limestone, at 70c per ton	6.30
Fluorspar, manganese, ore, etc	8.00
½ ton ferromanganese, at $60.00 per ton	30.00
	$1,364.30
Product 107 tons of ingots and scrap. Cost of raw material per ton of ingots produced	$ 12.75

This presupposes that the cost of the pig in both cases is the same, while in reality phosphoric pig is cheaper than Bessemer pig. The advantages of the Talbot over the ordinary basic open-hearth process are: 1. The delivery of hot ingots to the blooming mill furnace with more regularity; 2. A saving of 25 per cent. to 30 per cent. in first cost of plant; 3. Only one-third of the space is required for a given capacity; 4. Twenty per cent. less fuel is required per ton of ingots produced; 5. The labor per ton is less than one-half, and the yield is greater than ever reached by any other process.

APPARATUS.

A. H. GILL, REVIEWER.

Improvement in Orsat Apparatus. BY A. BEMENT. *J. Am. Chem. Soc.*, **23**, 57.—The "improvement" consists in the introduction of a glass disk to hold up the glass tubes in the pipettes. The abstractor recollects having seen fourteen years ago, a wire support for this purpose, which has been in use ever since.

An Automatic Filter Washer. BY J. M. PICKEL. *J. Am. Chem. Soc.*, **23**, 589–593.—The apparatus, which is especially designed for the determination of the water-soluble content of fertilizers, cannot well be understood without the figure. It would seem to be admirably adapted for its purpose.

An Easily Constructed Barometer. BY G. W. RUSSELL. *Am. Chem. J.*, **25**, 508–510.—This article describes an easy method of preparing a siphon barometer.

A New Coal Calorimeter. BY S. W. PARR. *J. Am. Chem. Soc.*, **22**, 646–652.—This instrument uses the principle of the L. Thompson calorimeter, that of burning the coal by the use of some chemical, sodium peroxide in this case. This has the very important advantage that it absorbs the products of combustion, thus preventing loss of heat from this cause. Results obtained varied by less than 0.8 per cent. from those of the bomb calorimeter.

Digitized by Google

Improved Electric Furnace for Laboratory Use. By S. A. Tucker and H. R. Moody. *J. Am. Chem. Soc.*, **23**, 473–476.—The improvement consists in the use of carbon bricks luted with graphite paste instead of the chalk blocks of the Moissan furnace. One inch electrodes pass in through clay or asbestos cylinders. The size of the furnaces in the clear was $6 \times 4 \times 2$ inches. Currents of 300 amperes at 70 volts were used.

An Apparatus for Determining Fat. By H. J. Wheeler and B. L. Hartwell. *J. Am. Chem. Soc.*, **23**, 338–343.—The apparatus, which is illustrated by a figure, consists of a battery of ten improved Knorr extractors. The improvements consist in part in the use of an ordinary flask and of a smaller quantity of dry ether, and in an arrangement serving to recover the ether.

Pharmacist's Apparatus Stand. By J. P. Remington. *Am. J. Pharm.*, **73**, 19–20. This stand consists of a pair of vertical supports carrying horizontal bars upon which the rings, burette clamps, etc., may be fastened.

The Use of Acetylene Gas as Fuel in Chemical Laboratories. By Arthur Lachman. *Am. Chem. J.*, **24**, 39–45.—The conclusions are that it does not pay to use acetylene as a laboratory fuel in place of gasolene gas. Although the cost of an acetylene equipment is less, the generator requires more than twelve times the attention, the gas must be purified from phosphine, and the flame cannot be regulated with sufficient accuracy for delicate work, such as the heating of thermostats; moreover a luminous jet deposits a large quantity of soot. The heat of combustion of gasolene gas is almost twice that of acetylene, and the cost about one-half: it would seem therefore inadvisable to use it from the standpoints of either cost, convenience, or practicability.

Apparatus for Generating Gases at Constant Flow and of High Efficiency. By G. A. Koenig. *Am. Chem. J.*, **24**, 373–7.—The apparatus, which is illustrated by a figure, provides for the heating of the generating vessel to about 80°. This insures a constant current of gas (of sulphuretted hydrogen or chlorine). It is also so arranged that the acid necessary for the generation be added in successive small portions, thus preventing waste. It seems to be novel and efficient.

A Modification of the Bunsen Vacuum Pump. By M. H. Ittner. *Am. Chem. J.*, **24**, 253–5.—The pump consists of a reservoir to provide a constant heat of air-free water, which is discharged through a jet into a bulb imparting a vertex motion to the water passing down the fall tube. The exhaust tube is taken off at such a point as almost to preclude the possibility of water striking back into the vessel evacuated.

Digitized by Google

A Multiple Fat Extractor. By C. L. Penny. *Am. Chem. J.*, **24**, 242–249.—The apparatus, which acts upon the Soxhlet principle, is constructed of metal, and permits of the extraction of 51 samples of milk, in capsules, at one time. These capsules are of tin-foil, and are 2 inches in diameter and $\frac{5}{8}$ of an inch deep. They are such as are used for capping salt-mouth bottles. Asbestos or coarse sand is used as an absorbent for cream. When the milk residue has dried, the capsules are packed vertically on the edge of the cylinder, and submitted to the action of the petroleum ether. No trace of mechanical loss has been observed when the racks used to hold the capsules fitted properly.

Two Devices for Circulating Liquids at Constant Temperature. By I. H. Derby. *J. Phys. Chem.*, **5**, 17–20.—One consists of a centrifugal pump in glass, the suction-pipe being at the top of the liquid and forcing it through a jacket of constant temperature to the bottom of the liquid. This has the disadvantage that the circulation may be insufficient. The other makes use of the Witt's stirrer, instead of the centrifugal pump above mentioned. This insures a thorough circulation of the liquid in the bath.

Electric Furnaces for the 110-Volt Circuit. By Nevil Monroe Hopkins. *J. Am. Chem. Soc.*, **20**, 769–773. —Two furnaces for laboratory use are described and illustrated by figures. One consists of three pairs of arc light carbons, which are inserted in an iron vessel lined with fire-brick, and are so connected that the three arc gaps are in series with one another, whereby it is made possible to reduce the external resistance necessary. This furnace may serve for preparing calcium carbide. The other furnace is smaller and has no special characteristics.

Digitized by Google

Review of American Chemical Research.

INDEX OF AUTHORS.

ACHESON, E. G., graphite: its formation and manufacture 66
Adams, C. F., an apparatus for the determination of the coefficient of expansion of air at constant pressure 162
Alden, F. W., and S. Nolte, quantitative estimation of carvone in volatile oils..... 41
Alderson, M. W., precipitations from solutions weak in cyanide, 29; precipitation in cyaniding..... 29
Aldrich, T. B., active principle of the suprarenal gland 187
Allen, E. T., and V. H. Gottschalk, new method for the determination of aluminium 37
Allen, E. T., and H. F. Rogers, action of caustic hydroxides on aluminium..... 13
Allen, F. B., basic nitrates of bismuth..... 101
Allen, W. M. See Kilgore, B. W.
Alpers, W. C., oil and terpenes of *aralia nudicaulis* 102
Alsop, W. K., and J. H. Yocum, composition of the ashes of some raw tanning materials 73
Ames, J. W. See Silby, A. D.
Andrews, L. W., new volumetric method for the determination of silver..... 36
Andrews, W. H. See Van Slyke, L. L.
Archibald, E. H. See Richards, T. W.
Arny, H. V. See Hatcher, R. A.
Ashley, H. E., sampling pig-iron..... 202
Atkins, M. D., polarization and internal resistance of electrolytic cells..... 193
Austin, A. E., origin of oxalic acid from protein and protein derivatives..... 188
Avery S., and H. T. Beans, soluble arsenious oxide in Paris green, 87; rapid method for the determination of arsenious oxide in Paris green..... 177

BADLAM, S. See Fay, H.
Bancroft, W. D., laboratory apparatus for decomposition voltages, 115; reaction velocity and equilibrium, 156; dissociation studies, II..... 156
Barnes, H. T., hermetically sealed type of Clark standard cell, 191; the density of ice, 153; See Callendar, H. L.
Barus, C., the compressibility of colloids, with applications to the jelly theory of the ether..... 2
Baskerville, C., universal distribution of titanium..... 14
Beahr, M. J., utilization of sugar-beet waste 185
Beans, H. T. See Avery, S.
Beardsley, H. P. See Wells, H. L.
Beatty, W. A. See Kastle, J. H.
Beck, W. P., rotation of the plane of polarization by mixtures..... 206
Becker, G. F., the gold fields of southern Alaska, with some notes on general geology, 88; mineral resources of the Philippine Islands..... 93
Beebe, G. W., cast-iron car-wheels..... 136
Beeson, J. L., nitric nitrogen produced by the pea..... 130
Behr, G. R. See Jackson, C. L.
Beistle, C. P. See Browne, C. A., Jr.
Bement, A., accuracy of carbonic acid determinations by the Arndt gravity eco-mometer, 203; improvement in the Orsat apparatus 224
Beneker, J. C. See Ellms, J. W.

Digitized by Google

Betts, A. G., method for the extraction of bromine 209
Bigelow, W. D., the composition of American wines 120
Bigelow, W. D. See Tolman, L. M.
Birkinbine, J., manganese ores, 92, 95; iron ores 51, 94
Bisbee, H. See Richards, T. W.
Bittenger, J. L., artificial stone 185
Bizzell, J. A. See Fraps, G. S.
Black, O. F. See Torrey, J., Jr.
Blair, A. A., determination of carbon in ferrochrome 35
Blanchard, A. A. See Noyes, A. A,
Blanchard, W. M. See Noyes, W. A.
Blasdale, W. C., heptane from coniferous trees 120
Bogert, M. T, and A. H. Gotthelf, direct synthesis of ketodihydroquinazolines from *o*-amino acids 5
Bolling, R., irregular distribution of sulphur in pig iron, 35, 99; modified Williams method for manganese 178
Bosqui, F. L., cyanide works of the Liberty Bell Gold Mining Co 31
Bosquin, O. H., spectrum of hydrogen given by the metallic arc of tin, copper, silver, etc 191
Bowers, H. L. See Schober, W. B.
Boyl, J., Mond fuel gas in Great Britain 185
Boynton, W. P. Gibbs' thermodynamical model, 158; the two specific heats of gases 160
Bradbury, R. H., reaction velocity 190
Brandel, I. W., and E. Kremers, thymoquinone in wild bergamot oil, 123; hydrothymoquinone in wild bergamot oil 123
Bretherton, A. E., pyritic smelting and hot blast 133
Bretherton, S. E., pyritic smelting and hot blast 133
Brewer, C. E. See Orndorff, W. R.
Briggs, L. J. See Cameron, F. K.
Brown, H. F., cheap mining and milling at Spanish Mine 23
Brown, J. W. See Mulliken, S. P.
Browne, C. A., Jr., and C. P. Beistle, complete analysis of feeding materials 120
Browne, D. H., nickel steel 61
Bryan, A. H. See Huston, H. A.
Buck, D. M. See Mabery, C. F.
Bunker, H. A., the bio-chemical basis of pathology 103
Burrows, G. H., relations between thermal and dynamic coefficients 160

CALDWELL, B. P. See Jones, H. C.
Callendar, H. L., and H. T. Barnes, variation of the specific heat of water between 0° and 100° 189
Cameron, F. K., soil solutions 183
Cameron, F. K., L. L. Briggs, and A. Seidell, solution studies of salts occurring in alkali soils 183
Camp, J. M., blast-furnace and steel works chemistry 176
Canter, H., *o*-phenylsulphonebenzoic acid and related compounds 123
Carhart, H. S., thermodynamics of the voltaic cell, 195; various determinations of the E. M. F. of the Clark cell 192
Carpenter, F. B., estimation of pyrrhotite in pyrite ores 33
Carpenter, F. R., pyritic smelting in the Black Hills 214
Cassel, H. R., the Riecken process for heating telluride and sulphide ores 133
Cayvan, L. L. See Woodman, A. G.
Chamot, E. M., micro-chemical analysis 203
Chance, H. M., gold ores in the Black Hills, S. Dakota 214
Chattaway, F. D., composition of nitrogen iodide 9
Chattaway, F. D., and K. J. P. Orton, action of light on nitrogen iodide, 10; action of alkaline hydroxides, of water, and of hydrogen peroxide on nitrogen iodide, 10; formation and constitution of nitrogen iodide 11
Chattaway, F. D., and H. P. Stevens, action of acids upon nitrogen iodide 11

Digitized by Google

Child, A. T., and W. P. Heineken, the microstructure of cast iron, as effected by heat treatment..... 220
Christy, S. B., electromotive force of metals in cyanide solutions..... 195
Churchill, J. B. See Richards, T. W.
Claassen, E., qualitative determination of the organic acids in the fruit of *rhus glabra*, *L* and of *rhus canadensis*, Marsh..... 179
Clark, A. J., plate-amalgamation..... 24
Clark, A. W., assay of belladonna root and its solid extract 123
Clark, J. F., toxic value of mercuric chloride and its double salts..... 186
Clarke, F. W., eighth annual report of the committee on atomic weights..... 143
Clarke, F. W., and G. Steiger, action of ammonium chloride upon analcite and leucite 73
Clover, A. M, See Freer, P. C.
Cohen, L. See Harding, E. P.
Cohoe, W. P. See Jackson, C. L.
Conn, W. T. See Michael, A.
Cook, A. N., and H. W. Hillyer, derivatives of phenyl ether..... 84
Cooper, J. R., electro-silvered versus plain copper plates..... 131
Cownley, A. J. See Paul, B. H.
Cotton, A., present status of Kirchoff's law, ... 191
Cottrell, F. G., the solubility of manganous sulphate 153
Crafts, J. M , catalysis in concentrated solutions 149
Craig, A. G., the determination of formaldehyde..... 142
Crampton, C. A., and F. D. Simons, detection of foreign coloring-matter in spirits 119
Croll, H. V., gold mining and milling in Georgia..... 24
Crowther, H. M., when to begin treatment of cyanide tailings..... 132
Cushman, A. S., isomeric halogen compounds of thallium and the constitution of double salts, 12 ; some modified forms of physico-chemical apparatus..... 161

DALE, T. N., the slate belt of eastern New York and western Vermont..... 90
Daly, R. A., calcareous concretions of Kettle Point, Ontario..... 47
Davies, C. T. See Job, R.
Davis, C. A., a remarkable marl lake, 50 ; constitution and natural history of marl 49
Davis, C. B., estimation of water in oil, fats, and waxes..... 205
Davis, G. C., annealing malleable cast iron..... 62
Davoll, D. L., diastasimetry 42
Day, A. L. See Holborn, L.
Day, D. T., occurrence of Fuller's earth in the United States, 69 ; phosphate rock. 93
Day, W. C., stone, 92, 96; laboratory production of asphalts from mineral and vegetable materials..... 67
Dennis, L. M., and O. W. Brown, potassium perselenate..... 196
Derby, I. H., apparatus for circulating liquids at constant temperature, 226 ; See Jackson, C. L.
Derby, O. A., mode of occurrence of topaz near Ouro Preto, Brazil..... 74
Dewar, J., boiling-point of liquid hydrogen, 150 ; the nadir of temperature and allied problems, 150 ; See Liveing, S. D.
Diller, J. S., Coos Bay coal fields, Oregon..... 91
Divine, R. E., a method of determining free alkali in soap..... 34
Douglas, J., Copper Queen mine, Arizona 19
Dresbach, M., the toxicity of normal urine..... 104
Drew, E. R., a determination of the viscosity of water..... 153
Duane, W., the velocity of chemical reactions 161
Duhem, P., the liquefaction of a mixture of two gases 160
Dustin, G. K. See Wheeler, H. L.

EARLE, R. B. See Jackson, C. L.
Ebersole, M. R., minimum boiling-points and vapor composition..... 155
Eckel, E. C., the Portland cement industry in New York..... 181
Ellms, J. W., the relative value of lacmoid, phenacetolin, and erythrosine as indicators in the determination of alkalinity of water... 117
Ellms, J. W., and J. C. Beneker, estimation of carbonic acid in waters 175, 180

Digitized by Google

Emerson, E., Emerson's method of producing electrolytic copper wire bars..... 21
Endemann, H., what is parianite? a correction..... 68
Evans, H. O., shrinkage of malleable iron castings..... 62
Exner, F., and Haschek, E., spectrum of silicon 191

FACKENTHAL, B. F., a peculiar silicious efflorescence from pig iron..... 218
Farrington, O. C., studies for students..... 140
Fay, H., and S. Badlam, effect of annealing upon the physical properties and micro-structure of a low carbon steel..... 101
Fay, H., and E. North, 2nd, nature of the lead amalgams..... 100
Fernandez, R., the patio process in Guanajuato..... 22
Ferrell, J. L., recent developments in the fire-proofing of wood..... 109
Fisher, H. See Miller, E. H.
Foote, W. M., occurrence of native lead with copper and other minerals at Franklin Furnace, N. J..... 87
Foster, O. R., relative desulphurizing effect of lime and magnesia in iron blast-furnace 60
Fraprie, F. R. See Richards, T. W.
Fraps, G. S., loss of sulphur in preparing ash of plants, 121; the determination of pentosans, 121; purification of phloroglucinol, 6; composition of a wood oil, 200; See Withers, W. A.
Fraps, G. S., and J. A. Bizzell, method of determining proteid nitrogen in vegetable matter 121
Freer, P. C., and A. M. Clover, the constituents of Jamaica dogwood 105
French, P. R. See Mulliken, S. P.
Friend, G. C., atomic weight of antimony 144
Fritchle, O. P., analysis of uranium and vanadium ores..... 40
Fuller, G. W., standard methods of water analysis 117, 180
Fulweiler, W. H., and E. F. Smith, precipitation and separation of silver in the electrolytic way..... 178

GARNER, W. W. See Remsen, I.
Genth, F. A., the detection of salicylic acid in foods..... 41
Gibson, H. W. See Vulté, H. T.
Gies, W. J. See Mead, L. D.
Gillespie, D. H. M. See Walker, C. F.
Godshall, L. D., assay of copper materials for gold and silver..... 208
Goldsmith, N. O., water-softening plant at the Lorain Steel Co's blast-furnace 70
Gomberg, M., preparation of triphenylchlormethane, 6; an instance of trivalent carbon; triphenylmethyl, 6; on triphenylchlormethane, 86; trivalent carbon 128, 173
Gomberg, M., and O. W. Voedisch, tritolylchlormethane..... 172
Gooch, F. A., and J. C. Morris, iodometric estimation of arsenic acid..... 97
Goodwin, H. M., and F. W. Grover, effect of temperature, colloidal ferric hydrate, and a magnetic field, on the hydrolysis of ferric chloride..... 145
Gordin, H. M., the alkaloids of *Ceanothers Americanus*, 102; assay of crude drugs 123
Gordon, F. W., heat and power from the waste gases of blast-furnaces 136
Gore, H. C. See McPherson, W.
Gorr, C. W., acetanilide 172
Gotthelf, A. H., synthesis of alkyl ketodihydroquinazolines from anthranilic acid, 174; See Bogert, M. T.
Gottschalk, V. H. See Allen, E. T.
Grant, U. S., contact metamorphism of basic igneous rock..... 43
Grover, F. W. See Goodwin, H. M.
Guenther, R., cellulith, 72; chemical industry of Germany..... 72

HALE, W. J. See Phelps, I. K.
Hall, C. M., method of making alumina, 135; process of purifying bauxite..... 184
Hall, E. J. See Miller, E. H.
Hall, R. D. See Kahlenberg, L.

Digitized by Google

Hall, R. W., cause of the loss of weight of commercial platinum when heated under some conditions 14
Hamburger, A., recent developments in textile processes 63
Hamilton, L. P., and E. F. Smith, alloys made in the electric furnace 100
Harding, E. P., and L. Cohen, 2-5-dimethylbenzaldehyde and some of its derivatives 173
Harker, A., igneous rock-series and mixed rocks 48
Harmon, D., stamp milling of free gold ores 131
Harris, E. L., electrolysis in bleaching textiles 182
Harrison, A. B., method for graphite in pig iron 98
Harrison, C. N. See Rowland, H. A.
Hartley, W. N., and H. Ramage, wave lengths of the principal lines in the spectrum of gallium 191
Hartranft, S. S., protection of blast-furnace linings 218
Hartshorne, J., notes on the Bertrand-Thiel process 223
Hartwell, B. L. See Wheeler, H. J.
Haschek, E. See Exner, F.
Hasselberg, B., arc spectrum of vanadium 191
Hatcher, R. A., and H. V. Arny, atmospheric ozone 15
Havens, F. S., separation of nickel and cobalt by hydrochloric acid 37
Haywood, J. K., composition and analysis of London purple, 86; the analysis of arsenical insecticides 34
Headly, R. D., results of smelting at Hall mines 18
Heath, G. C., colorimetric assays of copper 39
Heineken, W. P. See Child, A. T.
Helmer, L. L. See Noyes, W. A.
Henderson, W. E., symmetrical chloride of *p*-nitro-*o*-sulphobenzoic acid 84
Hendricks, W. E., chemical composition of monarda oils 102
Henning C., foundry iron 220
Henton, J. M., wet crushing and cyaniding the silicious ores of the Black Hills, South Dakota 30
Hess, W. H., origin of nitrates in cavern earths 46
Hexamer, C. J., a process of fire-proofing wood to be used for the woodwork of war vessels 65
Hidden, W. E., occurrence of sperrylite in North Carolina 88
Hilgard, E. W., free arsenious oxide in Paris green 34
Hill, H. B., on dehydromucic acid 162
Hill, H. B., and A. S. Wheeler, the reduction of dehydromucic acid 163
Hill, R. T., and H. B. C. Nitze, mineral resources of Porto Rico 96
Hillebrand, W. F., and H. N. Stokes, relative values of the Mitscherlich and hydrofluoric acid methods for the determination of ferrous iron 33
Hillebrand, W. F., and F. L. Ransome, carnolyte and associated vanadiferous minerals in Western Colorado 75
Hillyer, H. W. See Cook, A. N.
Hobbs, W. H., the crystallography of a reduction-product of Δ^4-terpene-3-one, 4; classification of igneous rocks 45
Hodges, A. W. B., new smelting works at Grand Forks, B. C 18
Hofman, H. O., the temperatures at which certain ferrous and calcic silicates are formed in fusion, and the effects upon their temperatures of certain metallic oxides 15
Holborn, L., and A. L. Day, gas thermometer at high temperatures, 190; melting-point of gold, 190; the expansion of certain metals at high temperatures .. 150
Holmes, W. B., the action of the chlorides of *o*-sulphobenzoic acid, and *p*-nitro-*o*-sulphobenzoic acids on urea 127
Hopkins, A. J., crystallization of copper sulphate 197
Hopkins, G. V., treatment of low grade silicious ores of the Rossland Camp by the cyanide process 32
Hopkins, N. M., electric furnace for the 110-volt circuit 226
Horn, D. W. See Morse, H. N.
Hough, G. J., aluminum as an electrode 35

Digitized by Google

Howe, H. M., equipment of metallurgical laboratories, 15; relative corrosion of wrought iron, soft steel, and nickel steel, 60; reduction roasting, its value for arsenic expulsion from copper ores and matte, 212; the influence of silicon and sulphur on the condition of carbon in cast iron, 220; the chemistry and physics of cast iron 221
Huff, W. B., spectra of mercury 191
Hudson, E. J. See Maberry, C. F.
Hughes, O. J. D., chemical foods in Germany 73
Humphreys, W. J., an efficient Boyle's law apparatus 162
Hunkel, C. G., the chemistry of rhubarb 141
Hunter, C. S., the agitation process for cyaniding slimes 132
Huston, H. A., W. J. Jones, and A. H. Bryan, marls 184
Hyde, H. St. J. See Sherman, H.

ILES, M. W., lead smelting and gold and silver refining at Globe Works, Denver, 17; lead smelting and gold and silver refining: the Fallis manometer, 18; refinery products 18
Irving, J. D., contact phenomena of the palisade diabase 54
Ittner, M. H., a modification of the Bunsen vacuum pump 225

JACKLIN, D. C., cyanide process at Mercur 27
Jackson, C. L., and G. E. Behr, symmetrical triiodbenzol 167
Jackson, C. L., and W. P. Cohoe, certain derivatives of *m*-dibromdinitrobenzol 165
Jackson, C. L., and I. H. Derby, ferrous iodide 7
Jackson, C. L., and R. B. Earle, the action of sodic sulphite on tribromdinitrobenzol and tribromtrinitrobenzol 166
Jackson, C. L., and W. Koch, certain derivatives of *o*-benzoquinone 165
Jackson, D. D., permanent standards for use in the analysis of water 118
James, C., the annealing of white cast iron 221
James, M. M. See Kremers, E.
Jameson, G. S. See Wells, H. L.
Janin, L., cyaniding cupriferous ores 217
Jewett, S. C., the real fuel ratio 33
Job, R., and C. T. Davies, rapid determination of carbon in steel 35
Johnson, T. B. See Wheeler, H. L.
Jones, H. C., the dissociating power of different solvents 158
Jones, H. C., and B. P. Caldwell, on aqueous solutions of double salts. IV. Iodides, cyanides, nitrates and sulphates 147
Jones, L. C., action of carbon dioxide on soluble borates 38
Jones, L. R., and W. A. Orton, killing weeds with chemicals 73
Jones, W. J. See Huston, H. A.
Joüet, C. H., analysis of lead and copper slags, 40; analysis of slags and cinders, 176; iron and manganese slags 176

KAHLENBERG, L., differences of potential between metals and non-aqueous solutions of their salts, 115; an improved method of determining latent heat of evaporation, 151; the latent heat of evaporation of a number of organic nitrogen-bearing compounds 151
Kahlenberg, L., A. A. Koch, and R. D. Hall, the theory of electrolytic dissociation as viewed in the light of facts recently ascertained 156
Kahlenberg, L., and H. F. Mehl, toxic action of electrolytes upon fishes 156
Kastle, J. H., and W. A. Beatty, effect of oxidizing agents on the reduction of mercuric chloride by oxalic acid, 12; the dissociation of phosphorus pentachloride in organic solvents 1
Kastle, J. H., and A. S. Loevenhart, lipase, the fat-splitting enzyme and the reversibility of its action 104
Kayser, H., arc-spectrum of iron, 191; arc-spectra of elements of the platinum group 191
Kebler, L. F., testing formaldehyde, 4; lithium bicarbonate, 15; oil of walnuts, 203; See Pancoast, G. R.
Keller, E., determination of impurities from copper in refining and converting 213

Digitized by Google

Kemp, J. F., granites of southern Rhode Island and Connecticut, 42; review of the titaniferous magnetites, 55; the titaniferous iron ores of the Adirondacks.. 91
Kilgore, B. W., and W. M. Allen, report on food products for 1900..... 120
Kirchoff, C., a decade of progress in reducing costs, 17; the Dominion Iron and Steel Co..... 135
Kirk, E., anthracite as cupola fuel..... 219
Knight, W. C., artesian basins of Wyoming..... 118
Knipp, C. T., surface-tension of water above 100°, 152; an automatic temperature regulator..... 161
Knowles, M., experimental filter plant at Pittsburg..... 118
Koch, A. A. See Kahlenberg, L.
Koch, W. See Jackson, C. L.
Koenig, G. A., apparatus for generating gases at constant flow and high efficiency, 225; mohawkite, stibiodomeykite, domeykite, algodomite, and some artificial copper arsenides..... 76
Kollock, L. G., and E. F. Smith, electrolytic determination of molybdenum, 175; electrolytic method applied to uranium..... 178
Koyl, C. H., cause of foaming in locomotive boilers..... 112
Kremer, H., recent progress in the study of vegetable foods and drugs..... 179
Kremers, E., molecular dissociation of nitroso compounds, 4; See Brandel, I. W.
Kremers, E., and M. M. James, volumetric estimation of methyl salicylate..... 41
Krug, W. H., comparative hide-powder tests, 107; See Wiley, H. W.
Kuchler, G. W., purification of acetylene..... 181
Kyle, T. D. See Warwick, A. W.

LACHMAN, A., the use of acetylene gas as fuel in chemical laboratories..... 225
Laird, E. R., absorption spectrum of chlorine..... 191
Lakes, A., chlorination mills at Cripple Creek, Col..... 216
Lamar, W. R., assay of cocoa..... 122
Lang, H., utilization of the heat of molten slag, 17; the province of pyritic smelting..... 134
Lash, H. W., the Talbot continuous open-hearth process..... 223
Lathbury, B. B., the Michigan Alkali Co's plant for manufacturing Portland cement from caustic soda waste..... 72
Lenher, V., sulphohalides of lead..... 197
Lesley, R. W., history of the Portland cement industry in the United States..... 64
Levene, P. A., preparation of nucleic acid, 4; the preparation of nucleic acids, 130; chemical nature of enzymes, 186; analysis of nucleic acid from different sources..... 187
Levene, P. A., and L. B. Mendel, decomposition products of edestin..... 188
Lewis, G. N., a new conception of thermal pressure and a theory of solutions..... 158
Lewis, P., effect of certain impurities on the spectra of some gases..... 191
Liebknecht, O., and A. P. Wills, magnetic molecular susceptibility of salts of the iron group..... 117
Lincoln, A. T., solvent action of vapors..... 155
Lindgren, W., gold and silver veins of Silver City, DeLamar, and other mining districts in Idaho, 93; mining districts of the Idaho Basin and the Boise Ridge, Idaho..... 90
Lindsay, C. F., conductivities of some double salts..... 146
Linebarger, C. E., heat evolved when liquids are brought in contact with powders 157
Liveing, S. D., and J. Dewar, the spectrum of the more volatile gases of atmospheric air, 150; the separation of the least volatile gases of atmospheric air and their spectra..... 151
Locke, J., the periodic system and the properties of inorganic compounds, 3; gradations in the properties of alums..... 145
Lodge, R. W., use of iron in assaying..... 106
Loevenhart, A. S. See Kastle, J. H.
Loew, O., catalysis and chemical energy..... 160
Logan, L. See Vulté, H. T.

Digitized by Google

Long, J. H., estimation of urea in urine, 142; the early history and the present condition of teaching of chemistry in the medical schools of the United States 188
Loomis, E. H., freezing-points of aqueous solutions of non-electrolytes 146
Lorain, S. H., the mines and mill of the Atacama Mineral Co., Taltal, Chili..... 57
Lord, E. C. E., geology and petrography of Monhegan Island 53
Luebert, A. G., modification of the sulphuric acid test for formaldehyde in milk... 178
Lunge, G., researches on nitrocellulose..... 210
Lyon, A. C. See Noyes, W. A.
Lyons, A. B., the specific gravity tables of the U. S. pharmacopoeia, 122; a new alcohol table..... 179
Lythgoe, H. C., rapid method for the detection of aniline orange in milk..... 119

MABERY, C. F., carborundum, 71; composition of Texas petroleum 211
Mabery, C. F., and D. M. Buck, hydrocarbons in heavy Texas petroleum 5
Mabery, C. F., and E. J. Hudson, composition of California petroleum 210
Mabery, C. F., and O. J. Sieplein, method of determining the fusing-points of asphalts 111
Mabery, C. F., and S. Takano, composition of Japanese petroleum..... 211
MacGregor, J. G., the application of the dissociation theory to the electrolysis of aqueous solutions containing two electrolytes with a common ion..... 116
MacNutt, B., the electromotive force of polarization of electrolytic cells for very small current densities..... 116
Magenan, W., practice of cyanide process at Mercur, Utah, 25; cyaniding stamp mill tailings in western America 216
Magie, W. F., the specific heat of solutions which are not electrolytes, II, 153; the formula for the depression of the freezing temperature of solutions 158
Mallet, J. W., formation of platinum tetrachloride from aqueous hydrochloric acid by atmospheric oxidation in contact with platinum black..... 198
Marshall, H., persulphates of rubidium, caesium, and thallium..... 14
Mason, F. H., charcoal production and recovery of by-products in Germany, 181; improvements in Welsbach gas lights, 181; manufacture of bronze powders in Germany 185
Mason, W. P., measurements of turbidity in water..... 117
Mathews, E. B., granitic rocks of the Pikes Peak quadrangle..... 47
Maxim, H., high explosives and smokeless powders and their applications in warfare 64
Mayne, E. A., fracture indicates quality..... 219
McCaffrey, C. F. See Richards, T. W.
McGill, A., cloves..... 120
McIlhiney, P. C., linseed oil and its adulterations..... 205
McKee, R. H., oxygen ethers of the ureas; methyl and ethyl isourea 169
McKenna, A. G., analysis of chrome and tungsten steels..... 98
McMurtrie, W., the condition, prospects, and future educational demands of the chemical industries..... 111
McNally, J. C., rubber in Guatemala..... 111
McPherson, W., nature of the oxyazo compounds..... 172
McPherson, W., and H. C. Gore, constitution of the oxyazo compounds..... 164
Mead, L. D., and W. J. Gies, physiological and toxicological effects of tellurium compounds, with a study of their influence on nutrition..... 103
Meade, R. K., a method of preparing normal, seminormal, and decinormal sulphuric acid, 87; method for preparing strictly tenth-normal, etc., hydrochloric or nitric acids..... 174
Mehl, H. F. See Kahlenberg, L.
Mellor, J. W., Bunsen's ice calorimeter..... 161
Mendel, L. B. See Levene, P. A.
Mendel, L. B., and E. S. Schneider, the excretion of kynurenic acid..... 187
Merriam, H. F. See Wheeler, H. L.
Merrill, L. H. See Woods, C. D.
Metzger, F. J. See Wells, H. L.
Merzbacher, A., and E. F. Smith, electrolytic oxidation of toluene..... 7

Digitized by Google

Michael, A., methyl cyanide as a catalytic agent; and a criticism of J. U. Nef's views of the Frankland, Wurtz, and Conrad reactions 128
Michael, A., and W. T. Conn, behavior of iodine and bromine towards chlorine heptoxide and perchloric acid 100
Michaelis, W., Jr., how to calculate the proper cement raw mixture for the given raw materials 72
Miller, E. H., and H. Fisher, lead and cadmium ferrocyanides 14
Miller, E. H., and E. H. Hall, ferrocyanide titration of zinc 40
Miller, E. H., and R. W. Page, quantitative determination of cadmium 176
Miller, W. W., Jr., analysis of emery from Virginia, 138; a sandstone from Augusta County, Va., 138; analysis of smithsonite from Arkansas 138
Mitchell, F. H. See Rogers, A.
Mixter, W. G., experiments with endothermic gases 2
Moerk, F. X., gasometric analysis 205
Moldenke, R. See West, T. D.
Moody, H. R. See Tucker, S. A.
Moore, B. E., spectrophotometric study of the hydrolysis of dilute ferric chloride solutions 146
Morris, J. C. See Gooch, F. A.
Morse, H. N., and D. W. Horn, action of carbon dioxide on the borates of barium, 8; the preparation of osmotic membranes by electrolysis 160
Morse, R. G., effect of heat-treatment upon the physical properties and microstructure of steel 60
Moyer, J. B., separation of metallic sulphides by means of hydrochloric acid 36
Moyer, J. L., the Lloyd reaction for morphine 142
Mulliken, S. P., J. W. Brown, and P. R. French, the importance of formic aldehyde as a product of the partial combustion of organic compounds 124
Mulliken, S. P., and H. Scudder, detection of methyl alcohol in mixtures 82
Munson, L. S. See Tolman, L. M.
Murray, C. B., power laboratory ore grinder 207

NEWBERRY, S. B., Portland cement; sketch of materials and process, 71; Portland cement 92
Nichols, E. L., temperature of the acetylene flame 189
Nichols, H. W., nitrates in cave earths 138
Nitze, H. B. C. See Hill, R. T.
Nolte, S. See Alden F. W.
Norris, J. F., some double salts containing selenium, 6; the non-existence of trivalent carbon 124
Norris, J. F., and W. W. Sanders, on triphenylchlormethane 85
Norris, R. S., *p*- nitro-*o*-tolylphenylsulphone and some of its derivatives 83
Norton, J. T., Jr., titration of mercury by sodium thiosulphate 39
North E., 2nd. See Fay, H.
Noyes, A. A., a modification of the usual method of determiniug transference numbers, and an investigation of the influence of the concentration on their values in the case of some trilonic salts, 148; the exact relation between osmotic pressure and vapor pressure 157
Noyes, A. A., and A. A. Blanchard, lecture experiments illustrating the electrolytic dissociation theory and the laws of the velocity and equilibrium of chemical change 3
Noyes, W. A., ziuc-copper couple for preparing zinc ethyl, 172; synthesis of derivatives of dimethylcyclopentanone, β,β-dimethyladipic acid, and α,β,β-dimethyladipic acid 173
Noyes, W. A., and W. M. Blanchard, camphoric acid; racemic campholytic acid and racemic dihydrohydroxycampholytic acid 171
Noyes, W. A., and L. L. Helmer, determination of sulphur in iron and steel 175
Noyes, W. A., and A. C. Lyon, reaction between chlorine and ammonia 197
Noyes, W. A., and E. E. Phillips, camphoric acid; structure and configuration of cistranscampholytic acid 78
Noyes, W. A., and R. R. Warfel, the boiling-point curve for mixtures of ethyl alcohol and water 154

Digitized by Google

OHLY, J., manufacture of uranium compounds, 112; the leaching of copper ores, 134; modern leaching processes, 134; modern production of alum and aluminium 210
Oilar, R. D., the Halpin color test for the detection of cotton seed oil 206
Orndorff, W. R., and C. E. Brewer, the constitution of gallein and coerulein 167
Orndorff, W. R., and E. D. Thebaud, two modifications of benzene-4-azoresorcin and the constitution of the oxyazo compounds 168
Orndorff, W. R., and J. E. Teeple, bilirubin, the red coloring-matter of the bile 186
Orton, K. J. P. See Chattaway, F. D.
Orton, W. A. See Jones, L. R.
Osborne, T. B., the vegetable proteids 186

PACKER, O. H., estimation of copper in ores by the modified cyanide process ... 40
Page, R. W. See Miller, E. H.
Palache, C., tellurides from Colorado 75
Palmer, A. de F., Jr., apparatus for measuring very high pressures 2
Pancoast, G. R., and L. F. Kebler, adulterations of essential oils 123
Parker, E. W., asphaltum and bituminous rocks, 95; abrasive materials, 92; asphaltum 92
Parmley, D., some rapid work on silicons 99
Parr, S. W., new volumetric method for the estimation of copper, 34; new coal calorimeter 224
Parsons, C. L., simple test to distinguish oleomargarine from butter, 119; use of metallic sodium in blowpipe analysis 207
Paschen, F. See Runge, C.
Patrick, G. E., household tests for the detection of oleomargarine and renovated butter 179
Patton, H. B., thomsonite, mesolite, chatazite from Golden, Colo 88
Paul, B. H., and A. J. Coronley, the chemistry of ipecacuanha 103
Peacock, J. C., the unpublished results of the investigations of tannins by the late Prof. Henry Trimble 4
Peckham, S. F., retene, petroleum, and asphaltene, 107; the technology of California bitumens 63
Penfield, S. L., the interpretation of mineral analysis 138
Penny, C. L., a multiple fat extractor 226
Peters, C. A., volumetric estimation of copper as the oxalate with separations from cadmium, arsenic, tin, and zinc, 97; estimation of calcium, barium, and strontium as the oxalates 176
Phelps, I. K., and W. J. Hale, dehydromucic acid and certain of its derivatives 162
Phillips, E. E. See Noyes, W. A.
Phillips, F. C., compounds of methyl sulphide with halides of metals, 129; determination of hydrogen in gas mixtures, 205; fluctuations in the composition of natural gas 210
Pickel, J. M., automatic filter washer 224
Pirrson, L. V., petrography of the igneous rocks of the Little Belt Mountains, Montana 94
Pond, F. J., and A. S. Shoffstall, action of sodium alcoholate upon anisylidene acetophenonedibromide 5
Prescott, A. B. the detection of methyl alcohol in presence of ethyl alcohol 141, 172
Prince, C. L., the foundry of the General Electric Co., at Schenectady, N. Y. 219
Puckner, W. A., assay of belladonna leaves, 41; assay of fluid extracts of belladonna, 41; extraction of morphine with immiscible solvents 179
Purington, C. W., mining industries of the telluride quadrangle, Colo 90
Putnam, C. H., shot iron, and how to recover it, and how to use it 219

RAMAGE, H. See Hartley, W. N.
Ramsey, R. R., effect of gravity and pressure on electrolytic action 192
Ransome, F. L. See Hillebrand, W. F.
Reed, C. J., gas polarization in lead accumulators, 115; electrochemical action 194
Reid, E., hydrolysis of acid amides 79
Remington, J. P., pharmacist's apparatus stand 225

Digitized by Google

Remsen, I., and H. J. Turner, the action of aromatic sulphonchlorides on thiourea 127
Remsen, I., and W. W. Garner, the action of aromatic sulphonchlorides on urea .. 126
Rice, G. D., manufacture of rubber in the Philippines..... 111
Richards, J., utilization of the waste from the use of white metal..... 182
Richards, J. W., determination of iron in magnetite ore by the specific gravity test, 35; recent progress in the aluminum industry, 68; aluminium at the Paris Exposition; 109; measurement of gold and silver in quantitative blowpipe analysis, 207; some blowpipe tests, 207; aluminum zinc alloys, 135; secondary reactions in electrolysis, 194; mohawkite, 139; blast-furnace gases in gas-engines 218
Richards, T. W., suggestions regarding the nomenclature of heat capacity, 159; the possible significance of changing atomic volumes, 159; the transition temperature of sodic sulphate, a new fixed point in thermometry, 1; a table of atomic weights of seventy-seven elements, 143; international atomic weights, 144; standard of atomic weights..... 144
Richards, T. W., and E. H. Archibald, a study of growing crystals by instantaneous photomicrography 154
Richards, T. W. and J. B. Churchill, use of the transition temperature of complex system as fixed points in thermometry..... 1
Richards, T. W., and F. R. Fraprie, the solubility of manganous sulphate..... 154
Richards, T. W., C. F. McCaffrey, and H. Bisbee, occlusion of magnesic oxalate by calcic oxalate and the solubility of calcic oxalate 201
Richardson, G. M., the constitution of benzene..... 126
Rickard, T. A., telluride ores and the treatment of them. 32
Ridenour, W. E., estimation of hydrate in the presence of alkali carbonate, 203; chemistry of deposits in steam boilers..... 180
Ries, H., origin of kaolin, 56; clay-working industry of the United States in 1897, 92; the kaolins and fire-clays of Europe..... 92
Rodda, J. H., cheap method of converting matte..... 19
Rogers, A., and F. H. Mitchell, preparation of the blue oxide of molybdenum and of metallic molybdenum..... 14
Rogers, F. J., apparatus for demonstrating Boyle's law..... 162
Rogers, H. F. See Allen, E. T.
Rogers, S. M., cupola practice in the Bessemer steel works..... 222
Rothwell, J. E., the Union Gold Extraction Co.'s mill at Florence, Col..... 215
Rossi, A. J., experiments with the titaniferous ores..... 60
Rowland, H. A., and C. N. Harrison, arc-spectra of vanadium, zirconium, and lanthanum..... 191
Ruegenberg, M. J., and E. F. Smith, separation of tungsten trioxide from molybdenum trioxide 35
Runge, C., red end of the red argon spectrum, 191; spectrum of krypton, 191; spectrum of sodium 191
Runge, C., and F. Paschen, compound triplets in the line spectra of mercury, 191; series of spectra of oxygen, sulphur, and selenium... 191
Runyan, E. G., a new indicator for use in determining total acidity of wines 141, 175
Russell, G. W., an easily constructed barometer..... 224

SANDERS, W. M. See Wheeler, H. L.
Sanders, W. W. See Norris, J. F.
Sargent, C. L., productions of alloys of tungsten and of molybdenum in the electric furnace 99
Saunders, A. P., the reaction between chloroform and potassium hydroxide 150
Saurel, P., I, the equilibrium of chemical systems. II, a theorem of van der Waals. III, the fundamental equation of a multiple point. IV, a property of the pressure volume diagram. V, on Clapeyron's equation. VI, a theorem of Le Chatelier. VII, a theorem of Roozeboom. VIII, the generalization of Clapeyron's equation. IX, the phase rule..... 160
Schlundt, H., the dielectric constants of nitriles..... 115
Schober, W. B., and H. L. Bowers, action of sulphuric acid on phenetol..... 85

Digitized by Google

Schneider, E. C. See Mendel, L. B.
Schreiner, O., saw palmetto oil, 102; the accurate measurements of tints and shades of color 122
Schumann, W., silver-mounted ware a menace to health 72
Scott, W. G., sampling pig iron 178
Scudder, H. See Mulliken, S. P.
Seidell, A. See Cameron, F. K.
Selby, A. D., and J. W. Ames, sugar-beet investigations in Ohio in 1900 212
Shelby, C. F., rapid determination of small amounts of copper in chilled slag 38
Shepherd, W. K., new solution for the copper voltameter 193
Sherman, H., and H. St. J. Hyde, determination of phosphoric acid as phosphomolybdic anhydride 33
Sherman, H. C., and J. F. Snell, heat of combustion as a factor in oil analysis 204
Shimer, P. W., silica and insoluble residue in Portland cement, 35; device for sampling pig iron 207
Shoffstall, A. S. See Pond, F. J.
Shumann, V., second spectrum of hydrogen beyond wave-length, 185 $\mu\mu$ 191
Shutt, F. T., chemistry of insecticides 107
Sieker, F. A., the detection of methyl alcohol in pharmaceutical preparations, 122; paraffine as a substitute for ether in the preparation of extract of nux vomica, 122; examination of American oil of peppermint for menthol 205
Sieplein, O. J. See Mabery, C. F.
Simons, F. D. See Crampton, C. A.
Smith, C. E., comparative accuracy of titrimetric and gasometric methods of estimating hydrogen dioxide 36
Smith, E. F. See Friend, G. C., Fulweiler, W. H., Hamilton, L. P., Kollock, L. G., Merzbacher, A., Ruegenberg, M. J., and Spare, R.
Smith, J. D. A., the colorimetric assay of copper 209
Smith, F. W., the analysis of explosives 178
Smith, G. O. See Tower, G. W., Jr.
Smith, T., electrolytic determination of copper 202
Smith, W. S. T., geological sketch of San Clemente Island 89
Snell, J. F. See Sherman, H. C.
Spalding, E. P., the quicksilver mines of Brewster, Texas 217
Spare, R., and E. F. Smith, electrolytic separation of mercury from copper 178
Sperry, E. S., steam metal, 21; disintegration of an alloy of nickel and aluminum, 21; name plates, 134; properties of brass made from copper containing suboxide and the effect of oxygen on copper 213
Speyers, C. L., some boiling-point curves 3
Spurr, J. E., classification of igneous rocks according to composition, 51; geology of the Yukon District, Alaska 88
Steiger, G. See Clarke, F. W.
Steinmetz, J. A., aluminum considered practically in relation to its general application in the arts and mechanics 68
Stevens, A. B., opium assay 179
Stevens, H. P. See Chattaway, F. D.
Stewart, O. M., Becquerel rays, a résumé 158
Stillman, H., the treatment of water for boilers 113
Stokes, H. N., the revival of organic chemistry, 173; See Hillebrand, W. F.
Storer, F. H., results of a search for other sugars than xylose and dextrose in the poducts of the hydrolysis of wood from the trunks of trees 105
Strauss, L., influence of silica on the loss of silver in scorification 207
Street, J. P., the determination of the availability of organic nitrogen in commercial fertilizers 121, 174
Struthers, J., the Hans A. French electrolytic process for extracting metals applied to copper-nickel matte 21
Stull, W. N., reversible reactions 202
Swain, R. E., formation of allantoin from uric acid in the animal body 188

TAFF, J. A., geology of the McAlester-Lehigh coal field, Indian Territory 91
Takano, S. See Mabery, C. F.

Digitized by Google

Taylor, A. E., vapor-pressure relations in mixtures of two liquids, III..... 155
Tays, E. A. H., Bryan mill as a crusher and amalgamation compared with the stamp-battery, 22; plate-amalgamation of gold and silver..... 214
Terne, B., ammonia and its sources..... 63
Thatcher, R. W., indirect weighing of quantitative precipitates..... 175
Thebaud, E. D. See Orndorff, W. R.
Thomas, S., reminiscences of the early anthracite iron industry..... 60
Thurston, R. H., aluminum-magnesium alloys..... 59
Tingle, A., new synthesis of secondary amines, 7; the synthesis of amines by the use of alkyl salicylates..... 125
Tingle, J. B., camphoroxalic acid derivatives..... 173
Tolman, L. M., L. S. Munson, and W. D. Bigelow, the composition of jellies and jams..... 120
Tone, F. J., carbide of silicon in cupola practice, a new softener..... 61
Torrey, J., Jr., and O. F. Black, some derivatives of α-nitro-β-dinitropropionic aldehyde..... 82
Tower, G. W., Jr., and G. O. Smith, geology and mining districts of the Tintic District, Utah..... 96
Townsend, C. P., improvements in the metallurgy of aluminium..... 212
Trevor, J. E., the fundamental equations of multiple points..... 160
Trowbridge, J., the spectra of hydrogen and the spectrum of aqueous vapor..... 190
Trowbridge, P. F., notes on sugar beets..... 105
Tsuruta, K., revision of some thermal data concerning benzene..... 153
Tucker, S. A., and H. R. Moody, improved electric furnace for laboratory use, 225; a comparison of the solubility of acetylene and ethylene..... 180
Turner, H. J. See Remsen, I.
Turner, H. W., nomenclature of feldspathic granolites..... 45
Tutwiler, C. C., estimation of hydrogen sulphide in illuminating gas..... 205

ULKE, T., rapid determination of copper and nickel in sulphide ores and matte, 38; rapid method of determining lime in blast-furnace slags..... 39

VAN NAME, R. G., sulphocyanides of copper and silver in gravimetric analysis 98
Van Slyke, L. L., and W. H. Andrews, analyses of Paris green and other insecticides..... 184
Veitch, F. P., chemical composition of Maryland soils..... 122
Vickers, C., making sand castings of copper..... 213
Voedisch, O. W. See Gomberg, M.
Vogel, J. S. F., the Smelting Corporation's works at Ellesmere Port, England..... 17
Volney, C. W., the constitution of barytocelestites, 137; decomposition of sodium nitrate by sulphuric acid, II..... 197
Vulté, H. T., and L. Logan, bromine and iodine absorption figures of various oils.. 204
Vulté, H. T., and H. W. Gibson, nature and properties of corn oil, determination of its constitution, 204; chemistry of corn oil..... 204

WAIT, C. E., welding copper: the Leibe process..... 18
Walker, C. F., and D. H. M. Gillespie, application of iodine in the analysis of alkalies and acids..... 38
Walker, P. H., volumetric determination of zinc..... 177
Warfel, R. R. See Noyes, W. A.
Waring, W. G., the purchase of zinc ores in the Joplin district..... 58
Warren, C. H., mineralogical notes..... 140
Warwick, A. W., and T. D. Kyle, bismuth assay..... 202
Washington, H. S., the statement of rock analyses, 39; igneous complex of Magnet Cove, Ark., 42; composition of kulaite, 50; chemical study of the glaucophane schists, 74; analyses of Italian volcanic rocks..... 87
Watson, H., evolution of 300-stamp mill on Douglas Island..... 23
Watson, T. L., origin of the phenocrysts in the porphyritic granites of Georgia.... 139
Weber, H. A., root tubercles in water culture..... 130
Weed, W. H., geology of the Little Rock Mountains with mineralogical notes..... 94
Weed, W. H., and L. V. Pirsson, geology and mineral resources of the Judith Mountains of Montana..... 89

Digitized by Google

Wells, H. L., purification of caesium materials, 198; caesium periodate and iodate-periodate 199
Wells, H. L., H. P. Beardsley, G. S. Jameson, and F. J. Metzger, double nitrates... 199
Wells, H. L., and F. J. Metzger, salt of quadrivalent antimony, 198; acid nitrates, 199; caesium-antimonious fluorides and other double halides of antimony, 199; separation of tungstic and silicic acids..... 174
Wells, H. L., and J. M. Willis, double chlorides of caesium and thorium, 200; caesium tellurium fluoride..... 200
West, T. D., characteristics of the chemical and physical properties of cast iron... 102
West, T. D., and R. Moldenke, the grading of casting..... 219
Westgate, L. G., a granite-gneiss area in Central Connecticut..... 44
Wheeler, A. S. See Hill, H. B.
Wheeler, H. L., thiourea-amidines, 129; some addition reactions of thio acids..... 173
Wheeler, H. L., and G. K. Dustin, molecular rearrangement of disubstituted thion-carbonic esters..... 80
Wheeler, H. J., and B. L. Hartwell, an apparatus for determining fat 225
Wheeler, H. L., and T. B. Johnson, the behavior of acylthion carbamic esters with alkyl iodides and amines, 77; on acetyl and benzoylimidodithiocarbonic esters 170
Wheeler, H. L., and H. F. Merriam, the action of alkyl thiocyanates and alkyl isothiocyanates with thiol acids 129
Wheeler, H. L., and W. M. Sanders, urea-imido esters, thio-urea-imido esters, acyl-thio-urea-imido esters, and urea-amidines..... 4
White, A. H., oxidation of nitrogen as a source of error in the estimation of hydrogen and methane..... 177
Wiley, H. W., and W. H. Krug, comparison of the international filter-tube method and the official hide-powder method 107
Williams, C. B., Kilgore's modification of the volumetric method of estimating phosphoric acid..... 86
Williams, F. H., influence of copper in retarding corrosion of soft steel and wrought iron... 137
Williams, N. H., the verification of Boyle's law 162
Williams, W. J., methods for the examination of explosives, 65; powder as distinguished from explosives..... 110
Willis, B., coal fields of Puget Sound..... 89
Willis, J. M. See Wells, H. L.
Wills, A. P. See Liebknecht, O.
Wilsing, J., effect of pressure upon the wave-lengths of the lines of the hydrogen spectrum 191
Winchell, A. N., mineralogical and petrographic study of gabbroid rocks of Minn., and more particularly of the plagioclasites..... 52
Withers, W. A., and G. S. Fraps, the rate of nitrification of some fertilizers 142
Wood, N. P., testing losses in flue dust in cupola furnaces 18
Woodman, A. G., and L. L. Cayvan, the determination of phosphates in potable waters 118
Woods, C. D., and L. H. Merrill, analyses of food materials 179
Wyatt, F., the influence of science on modern beer brewing..... 69

YOCUM, J. H. See Alsop, W. K.
Young, S. W., studies on solutions of tin salts, 148; an electrically heated and electrically controlled thermostat 161

ZALINSKI, E. L., high explosives; their uses in peace and war..... 110

Digitized by Google

INDEX OF SUBJECTS.

ABRASIVES, occurrence and statistics of production 92
Accumulators, lead, gas polarization in 115
Acetanilide, physical and chemical tests for 172
Acetic aldehyde, separation from formic aldehyde 124
Acetone, partial combustion 124
Acetonitrile, latent heat 151
Acetylene: purification, 181; solubility, 180; flame, temperature, 189; use as fuel in laboratories 225
Acetylimidodithiocarbonic esters 170
Acyldithiocarbamic esters 130
Acylimidodithiocarbonic esters 129
Acylthio urea-imido esters 4
Acylthioncarbonic esters, reactions with alkyl iodides and amines 77
Acids, standard, preparation 174
Air, separation of hydrogen, helium, and neon from 151
Alaska, geology of gold fields 88
Alcohol: specific gravity table for, 179; boiling-point of mixtures of, with water 154
Aldehyde, polymerization 156
Algondite 76
Alkalies: caustic, estimation in presence of carbonate, 203; standardization with iodine 38
Alkaloids of *ceanothus Americanus* 102
Alkyl: halides, action of sodium on, in presence of methyl cyanide, 128; salicylates, action of aniline on, 7; thiocyanates, action with thiol acids 129
Allantoin, formation in animal body 188
Alloy: nickel and aluminum, disintegration, 21; for steam valves 21
Alloys: made in electric furnace, 99, 100; aluminum-magnesium 59
Alum, production 210
Alums: properties as related to periodic system, 145; physical properties 145
Alumina, manufacture 135
Aluminates of alkalies and alkaline earths 13
Aluminum: action of caustic alkalies on, 13; as an electrode, 35; alloys with nickel, 21; alloys with zinc, 135; alloy with magnesium, 59; new method for estimating, 37; melting-point, 190; at the Paris Exposition, 109; production, 210; improvements in metallurgy, 212; industry, recent progress, 68; use as conductor and reducing agent, 210; uses, 68; oxide purification. 212
Amalgam press 131
Amalgamator, Bryan mill as 22
Amalgamation, plate 24
Amalgams, lead, nature 100
Amides, hydrolysis 79
p-Amido-*o*-tolylphenylsulphone 84
Amines: synthesis from alkyl salicylates, 125; secondary, synthesis from alkyl salicylates 7
2-Amino-4-methylphenyl ether 84
Ammonia: industrial preparation, 63; reaction with chlorine 197
Analcite, action of ammonium chloride on 73
Analysis: microchemical, 203; blowpipe, use of sodium in 207
Andesite, analysis 87
Aniline: action on alkyl salicylates, 7; orange in milk, test for 119
Anisylidene acetophenonedibromide 5
Annealing, effect on low carbon steel 101
Anorthite 140
Anthracite, as cupola fuel 219

Digitized by Google

Antimony: atomic weight, 144; quadrivalent salt, 198; melting-point, 190; double fluorides with caesium, 199; separation from lead, 36; recovery from waste 182
Apparatus: for measuring high pressures, 2; Orsat, improvement, 224: for washing filters automatically, 224; for fat determinations, 225; stand for pharmacists, 225; for multiple fat extraction, 226; for circulating liquids at constant temperature, 226: for generating gases, 225; for decomposition voltages, 15; to demonstrate Boyle's law, 162; for determining coefficient of expansion of air, 162; physico-chemical 161
Argon: atomic weight, 143; spectrum 191
Aralia nudicaulis, terpenes in 102
Araliene 102
Arsenic: expulsion from copper ores and matte, 212; separation from lead, cadmium, and silver, 36; separation from copper, 97; acid, iodometric estimation 97
Arsenides, copper, artificial 76
Arsenious oxide, determination in Paris green 34, 177
Asphaltene 107
Asphalts: analysis, 108; artificial preparation, 67; determination of fusing-points 111
Asphaltum: production, 95; production and imports 92
Assay of drugs 123
Assaying, use of iron in 106
Atomic weights: of antimony, 144; standard, 144; published in 1900, 143; international 144
Aurous chloride, compound with methyl sulphide 129

BARIUM: estimation as oxalate, 176; borates, action of carbon dioxide on, 8: chloride, transference number, 148; nitrate, transference number 148
Barometer, an easily constructed 224
Barytocelestites, constitution 137
Bauxite: purification, 184; electrolytic purification 212
Becquerel rays 158
Beer brewing, improvements in 69
Beet: sugar, investigations in Ohio and Kansas, 212; utilization of waste 185
Beets, amount of sugar in 105
Belladonna, assay 41, 123
Benzene: constitution, 126; vapor-pressure, specific volume, heat of vaporization, 153; disulphoxide 127
Benzene-4-azoresorcin, two modifications 168
Benzenesulphonchloride, action on urea 126, 127
Benzoic acid, vapor-pressure 155
Benzonitrile, latent heat 151
o-Benzoquinone and derivatives 165
o-Benzoyldiphenylsulphone 124
Benzoylimidodithiocarbonic esters 170
Benzoylimidothiocarbamic esters 77
α-Benzoyl-α-naphthylhydrazine 164
Benzoylpseudoureas 77
Benzoylureas 77
Bertrand-Thiel process 223
Bicarbonates, estimation 183
Bilirubin 186
Bio-chemistry, relation to pathology 103
Bismuth: assay, 202; separation from lead, 36; basic nitrates 101
Bitumens, of California 63
Blast-furnace: desulphurizers in, 60; waste-gases in, 136; linings, protection 218
Bleaching by electrolysis 182
Boiling-point curves 3
Boiling-points: minimum and vapor composition, 155; of mixtures of alcohol and water 154
Boilers: foaming in, cause, 112; nature of deposits in 180

Digitized by Google

Boiler-water, treatment 113
Borates, action of carbon dioxide on..... 38
Brass: properties, 213; effect of contained oxygen on..... 213
Brewing, history and development..... 69
Bromanilidodinitrobenzene..... 165
β-Bromdihydrocampholytic acid 79
Bromine: behavior with chlorine heptoxide and perchloric acid, 110; recovery from brine, 209; amount in ocean and Dead Sea..... 209
Bronze powders, manufacture..... 185
Butter, test to distinguish from oleomargarine.. 119

CADMIUM: determination, 176; melting-point, 190; electrolytic separation from silver, 178: separation from copper, 97; separation from zinc, 202; separation from arsenic, 36; ferrocyanides 14
Caesium; double chloride with thorium, 200; double fluoride with tellurium, 200; material, purification, 198; acid nitrates, 199; antimony fluorides, 199; bismuth nitrate, 199; ferric nitrate, 199; periodate, 199: persulphate 14
Calcium: atomic weight, 143; determination in slags, 39; estimation as oxalate, 176; separation from magnesium, 201: carbonates, solubility in salt solutions, 183; oxalate, solubility, 201; silicates, temperature of formation 15
Calorimeter: modified, 161; new, for coal..... 224
Campholytic acid, racemic..... 171
Camphoric acid..... ..... . 78, 171
Camphoroxalic acid derivatives..... 173
Carbon: rapid determination in steel, 35; in cast iron, influence of silicon and sulphur on, 220; trivalent, 124. 128, 173; dioxide, estimation in water, 180; dioxide, action on borates of barium, 8; action on soluble borates..... 38
Carbonates, estimation, 183; equilibrium between, and bicarbonates..... 183
Carbonic acid: determination in water, 175; determination by Arndt method 203
Carborundum: use in cupola practice, 61; patent claims for 71
Carnolite: analysis, 112; occurrence in Colorado..... 75
Carvone, estimation in oils..... 41
Castings: grading, 219; steel, Tropenas process for... 137
Catalysis: and chemical energy, 160; in polymerization of aldehyde, 156; in concentrated solutions, 149; in oxidation of stannous chloride by air..... 149
Ceanothine..... 102
Cell: Clark, new form, 191; Clark, E. M. F., 192; electrolytic polarization, 193; voltaic, thermodyamics..... 195
Cellulith 72
Cement: Portland, 92; Portland, analysis, 35; Portland, manufacture, 71, 72; Portland, history, 64; Portland, industry in New York..... 181
Cephaeline, presence in ipecacuanha 103
Chabazite, occurrence in Colorado..... 88
Charcoal, production..... 181
Chemistry: organic, revival, 173; teaching of, in medical schools..... 188
Chlorination at Cripple Creek 217
Chlorine: spectrum, 191; reaction with ammonia, 197; heptoxide, behavior with bromine and iodine 100
Chloroform, velocity of decomposition with potassium hydroxide..... 150
Chromium, estimation in steels..... 98
Ciminite, analysis 87
Cinders, analysis 176
Cistranscampholytic acid, structure..... 78
Clay industry in United States 92
Clays, fire, of Europe..... 92
Cloves, analysis..... 120
Coal: analyses, 136; new calorimeter for analysis, 224; occurrence in Philippine Islands, 93; field, Coos Bay, geology, 91; fields of Puget Sound, 89; fields, McAlester-Lehigh, geology..... . 91
Cobalt: alloys with molybdenum and tungsten, 59; separation from nickel..... 37

Digitized by Google

Coca, assay 122
Coefficients, thermal and dynamic 160
Coerulein, derivatives and constitution 167
Coking, cost 17
Colloids, compressibility 2
Complex, igneous, of Magnet Cove, Ark 42
Concretions, calcareous, of Kettle Point, Ont 47
Conductivity of double salts 146, 147
Contact phenomena of the palisade diabase 54
Copper: melting-point, 190; influence on corrosion of steel and iron, 137; occurrence in Philippine Islands, 93; refining, elimination of impurities in, 213; welding, 18; estimation as sulphocyanide, 98; electrolytic determination, 202; new volumetric method for, 34; colorimetric determination, 39; colorimetric assay, 209; volumetric estimation, 97; determination in chilled slag, 38; determination in ores by cyanide process, 40; determination in ferrochrome, 35; determination in sulphide ores and matte, 38; electrolytic separation from mercury, 178; separation from cadmium, arsenic, tin, and zinc, 97; arsenides, occurrence, 76; castings, method of making, 213; materials, assay for gold and silver, 208; -nickel matte, electrolytic working, 21; ores, leaching, 134, ores of Porto Rico, 96; slags, analysis, 40; sulphate, crystallization, 197; -wire, electrolytic production, 21; voltameter, 193; see also cuprous.
"Coronet rolls" 106
Crusher, Bryan mill 22
Crystals, study of growth 154
Cupola practice: fuel ratio in, 33; in Bessemer works 222
Cuprous chloride, compound with methyl sulphide 129
Curve, boiling-point, of alcohol and water 154
Curves, boiling-point 3
Cyaniding: cupriferous ores, 217; silicious ores, 30, 32; slimes, 132; tailings, 132, 217; precipitation in, 29; at Taltal, Chili, 58; at Liberty Bell Mine, 31; at Mercur 25, 27

DEHYDROMUCIC acid: reduction, 163; preparation, properties, and derivatives 162
Dehydromucicdiacetic anhydride 163
Desulphurization, use of lime and magnesium for 60
Diabase, palisade, contact phenomena 54
Diastasimetry 42
aa'-Dibenzoylfurfuran 163
m-Dibromdinitrobenzene and derivatives 165
Dibrom-*m*-phenylene diamine 165
Dibromdinitrobenzene 167
Dielectric constants of nitriles 115
Dihydroaminocampholytic acid 79
Dihydro-α-campholytic acid 172
Dihydrohydroxycampholytic acid 79, 171
β,β-Dimethyladipic acid 173
Dimethylamine, double salts with selenium halides 6
2,5-Dimethylbenzaldehyde 173
Dimethylcyclopentanone 173
o-Dioxydiphenylsulphone 165
Diphenoxydinitrobenzene 165
Dissociation: electrolytic, probability of theory, 156; electrolytic, lecture experiments illustrating 3
Dissociating powers of solvents 158
Dogwood, Jamaica, constituents 105
Domeykite 76
Drugs: assay, 123; properties and constituents 179
Dust, flue, losses in 18
Dynamite, properties and uses 110

Digitized by Google

EARTH: Fuller's, production, 96; Fuller's, occurrence in United States 69
Edestin, decomposition-products 188
Electrode, aluminum 35
Electrolysis: secondary reactions in, 194; of solutions containing substances with common ion, 116; in bleaching textiles 182
Electrolytic: action, in batteries, 194; action, action of gravity and pressure on, 192; production of copper wire, 21; process for working copper matte 21
Electromotive force: of metals in cyanide solutions, 195; of polarization of cells .. 116
Emery, analysis 138
Emetine, presence in ipecacuanha 103
Enzymes, chemical nature 186
Equilibrium: of chemical systems, 160; reaction and velocity, 156; chemical, experiments illustrating 3
Erythrosine, value as indicator in water analysis 117
Ether, jelly theory 2
Ethyl: chlorcarbonate, action on salts of carbonic and carbamic acids, 82; isourea, 169; malonate, action of zinc and ethyl iodide on, 128; salicylate, action of ammonia and amines on 125
Ethylene, solubility 180
Experiment Station Bulletin 120
Explosives: analysis, 178; analysis and tests for, 66; properties and applications, 64; high, uses 110

FAT: apparatus for determining, 225; multiple extractor 226
Fats, determination of water in 205
Feeding materials, analyses 120
Ferric chloride; hydrolysis, 145, 146; colloidal, effect of temperature, etc., on 145
Ferrochrome, determination of copper in 35
Ferro-titanium 60
Ferrous iodide, preparation and properties 7
Ferrous silicates, temperature of formation 15
Fertilizers: analyses, 73, 113, 184; determination of available nitrogen in, 121; determination of organic nitrogen in, 174; rate of nitrification in 142
Filtration of water supply at Pittsburg 118
Fire-proof wood 65, 109
Foaming in boilers, cause 112
Food: materials, analyses, 179; constituents 179
Foods: chemical, in Germany, 73; detection of salicylic acid in, 41; analysis, for preservatives and coloring-matters 120
Formaldehyde: determination, 4, 142; use in textile industries, 63; test for, in milk, 178; separation from acetic aldehyde, 124; as product of partial combustion 124
Foundry of General Electric Co 219
Freezing-point: formula for depression, 158; of solutions of non-electrolytes 146
Fuel ratio in cupola practice 33
Furaloid 121
Furnace, electric 225, 226

GADOLINIUM, atomic weight 143
Gallein, derivatives and constitution 167
Gallium, spectrum 191
Gas: for laboratories, 225; natural, fluctuations in, 210; fuel, Mond 185
Gas engines, use of blast-furnace gases in 218
Gases: analysis, 205; endothermic, explosion, 2; generating, apparatus for, 225; liquefaction, 160; waste of blast-furnace, heat from, 136; the two specific heats 160
Gaslights, Welsbach, improvements in 181
Geology: of gold fields of Alaska, 88; of San Clemente Island, 89; of Little Rock Mountains, Montana, 94; of Monhegan Island, 53; of the McAlester-Lehigh coal fields, 91; of slate belt of New York and Vermont, 90; of Judith Mountains, Montana, 89; of coal fields of Puget Sound, 89; of Coos Bay coal field, Oregon, 91; of Tintic District, Utah 96

Digitized by Google

Gland, suprarenal, principle 187
Glass, new German 73
Globulin edestin 186
Gold : amalgamation process for, 131; assay, in copper materials, 208; quantitative determination by blow-pipe, 207; extraction by plate amalgamation, 214; extraction, Union Gold Co's mill, 215; extraction by Dexter Gold Mining Co., 216; fields of Alaska, geology, 88; melting-point, 190; mines at Taltal, Chil, 57; mining in Georgia, 24; occurrence in Philippine Islands, 93; ores, stamp-milling, 131; ores low grade cyaniding, 32; ores, cyaniding, 25. 27, 29, 30, 31; ores of Black Hills, 214; refining, 18; refining, at Globe Works, Colo., 17; veins of Idaho, 93; see also Aurous.
Goldschmidtite 76
Graphite : estimation in pig iron, 98; formation and manufacture 66
Granite-gneiss area in Conn. 44
Granites : of Pikes Peak, 47; of Atlantic coast 42
Granolites, feldspathic, nomenclature 45
Grinder for ores 207
Guanyl urea, benzene sulphonate, action of acid on 127
Guncotton, properties and use 110
Gutta percha, substitute for 72
Gypsum, solubility in solutions of salts 183

HALPIN color test 206
Health, silver-mounted ware a menace to 72
Heat : latent, improved method for determining, 151; latent, of some organic compounds, 152; specific, of solutions, 153; evolution when powders treated with liquids, 157; capacity, nomenclature 159
Heat-treatment of steel, effect on microstructure 60
Heats, specific of gases 160
Helium : atomic weight, 143; separation from air 151
Heptane, occurrence in trees 120
Heroin, test for 142
Hexabrom-*o*-quino-pyrocatechin ether 166
Hide powder tests, comparative 107
Hydrocarbons in Texas petroleum 5
Hydrochloric acid : influence of stannous chloride on conductivity, 148; effect on decomposition of sulphonic acids 149
Hydrogen : boiling-point, 150; determination in gas mixtures, 205; errors in determinations, 177; heat of vaporization and fusion, 151; melting-point, 151; presence in atmosphere, 150; refractive index, 151; spectra, 190; spectrum, 191; dioxide, determination, 205; dioxide, estimation in presence of preservative agents, 36; sulphide, determination in illuminating gas 205
Hydrolysis : of acid amides, 79; of ferric chloride 145
Hydrothymoquinone, presence in bergamot oil 123

ICE density 153
Ichtulinic acid, analysis 187
Indicator : new, 141; for determining acidity of wines 175
Industries, chemical : condition, 111; of Germany 72
Insecticides : analysis, 184; arsenical, analysis, 34; chemistry 107
Iodine : use to standardize alkalies, 38; action on chlorine heptoxide and perchloric acid 100
Ipecacuanha 103
Iron : atomic weight, 143; corrosion, influence of copper on, 137; determination of sulphur in, 175; ferrous, determination, 33; determination in magnetite ore, 35; expansion at high temperatures, 150; spectrum, 191; use in assaying, 106; group, salts, magnetic molecular susceptibility, 117; industry, early, 60; cast, influence of silicon and sulphur on, 220; cast, effect of heat-treatment on microstructure and physical properties, 220; cast, chemistry and physics, 221; white cast, annealing, 221; cast, characteristics, 102;

Digitized by Google

castings, malleable, shrinkage, 62; malleable, cast, annealing, 62; malleable, cast, properties, 61; malleable, cast, manufacture, 220; foundry, 220; ores of the Adirondacks, 91; ores, 91, 94; ores of Porto Rico, 96; pig, cost of production, 17; pig, silicious efflorescence in, 218; pig, sampling, 178, 202, 207; pig, distribution of sulphur in, 99; pig, irregular distribution of sulphur in, 35; pig, fracture of, as an indication of quality, 219; pig, estimation of graphite in, 98; shot, 219; works at Cape Breton, 135; wolframite, 140; wrought, corrosion, 60. See also Ferrous and Ferric.

Isoamyl salicylate, action of ammonia and amines on 125
Isoureas, reactions 170
Jellies, analysis 120

KAOLIN, origin 56
Kaolins of Europe 92
Ketodihydroquinazolines, preparation 5, 174
Kynurenic acid, excretion 187
Krypton: atomic weight, 143; separation from air, 151; spectrum 191
Kulaite, composition 50

LABORATORIES, metallurgical, equipment 15
Lacmoid, value as indicator in Hehner's method 117
Lanthanum, spectrum 191
Latent heat of some organic compounds 152
Leaching of copper ores 134
Lead: amalgams, nature, 100; ferrocyanides, 14; melting-point, 190; recovery from waste, 182; separation from arsenic, antimony, bismuth, 36; native, occurrence with copper, 87; slags, analysis, 40; smelting, 18; smelting, cost, 17; sulphohalides 197
Ledouxite 139
Leucite, action of ammonium chloride on 73
Leucitite, analysis 87
Light, action on mercuric chloride and oxalic acid 12
Lime: use as a desulphurizer, 60; determination in slags 39
Linseed oil, analysis 205
Lipase, reversibility of action 104
Lithium bicarbonate 15
London purple, composition and analysis 86
Lyddite, use 110

MAGNESIA, use as desulphurizer 60
Magnesium: alloys with aluminium, 59; separation from calcium, 201; oxalate, occlusion by calcium oxalate 201
Magnetic molecular susceptibility of salts of iron group 117
Magnetite, determination of iron 35
Magnetites, titaniferous, review 55
Malonic ester, action of zinc and ethyl iodide on 128
Manganese determination, 178; ores 92, 95
Manganous sulphate, solubility 153, 154
Marl: natural history, 49; lake, remarkable 50
Marls, analysis and use as fertilizers 184
Matte, cheap method of converting 19
Melinite, use 110
Membranes, osmotic, preparation 160
Menthol, determination in peppermint oil 205
Mercerization, description 63
Mercuric chloride: reduction by oxalic acid, 12; toxic value 186
Mercury: electrolytic separation from copper, 178; recovery from waste, 182; spectrum, 191; titration with sodium thiosulphate, 39; chloride, compound with methyl cyanide, 129; mines of Brewster Co., Texas, 217; extraction 217
Mesolite, occurrence 88
Metal, steam 21

Digitized by Google

Metals, expansion at high temperatures 150
Metallurgy at McGill University 131
Metamorphism, contact of a basic igneous rock 43
Meteorites, composition and origin 140
Methane, errors in determination 177
α,γ-Methoxyphenylphenylisoxazole 5
Methyl alcohol: detection, 122; detection in mixtures, 82; detection in presence of ethyl alcohol 141, 172
Methyl cyanide as catalytic reagent 128
Methyl isourea 169
Methyl salicylate; estimation, 41; action of ammonia and amines on 125
Methyl sulphide, compounds with metallic halides 129
Methyl telluride, physiological effect 104
Milling: stamp. of gold ores, 131; in Georgia, 24; at Spanish Mine 23
Milk, test for formaldehyde in 178
Mine, Copper Queen 19
Mineral: analyses, interpretation, 138; deposits of Montana, 94; resources of Judith Mountains, Montana, 89; resources of Porto Rico, 96; resources of Philippine Islands 93
Minerals of Idaho Basin and Boise Ridge, Idaho 90
Mining: at McGill Univ., 131; at Spanish Mine, 23; in Idaho, 90; in Georgia, 24; industry of Tintic District, Utah, 96; industries at the telluride quadrangle, Colo 90
Model, Gibbs' thermodynamical 158
Mohawkite 76, 139
Molybdenum: alloys with nickel, cobalt, and chromium, 99; electrolytic determination, 175; preparation, 14; blue oxide, preparation, 14; trioxide separation from tungsten trioxide 35
Monarda Punctata L 102
Morphine: extraction, 179; "Lloyd" reaction for 142
Multiple-point 160

α-NAPHTHALENEAZOPHENOL 164
Naphthenes, occurrence in California petroleums 211
Neon: atomic weight, 143; separation, from air 151
Nickel: alloy with aluminum, 21; alloys with tungsten and molybdenum, 99; determination in sulphide ores and matte, 38; separation from cobalt, 37; expansion at high temperatures, 150; steel, corrosion 60, 61
Nigrite 95
Nitrates, acid, 99; basic, of bismuth, 101; double, 199; origin in cavern earths 46, 138
Nitrification in fertilizers, rate 142
Nitriles, dielectric constants 115
p-Nitro-*o*-benzoylbenzenesulphone chloride 84
α-Nitro-β-dinitropropionic acid, and derivatives 82
2-Nitro-4'-methylphenyl ether 84
p-Nitro-*o*-phensulphonebenzamide 84
p-Nitro-*o*-phenylsulphonebenzoic acid 84
p-Nitro-*o*-sulphobenzoic acid, symmetrical chloride 84
p-Nitro-*o*-toluenesulphone chloride 84
p-Nitro-*o*-tolylphenylsulphone and derivatives 83
Nitrocellulose 210
Nitrogen: atomic weight, 143; determination in fertilizers, 121; occurrence in natural gas, 210; atmospheric, fixation by roots, 130, available organic in fertilizers, determination, 174; nitric produced by the pea, 130; proteid, determination, 121; iodide, action of acids on, 11; iodide, formation and constitution, 11; iodide, composition, 9; iodide, action of light, hydroxides water, and hydrogen peroxide on 10
Nitroglycerine, use 110
2-Nitrophenylether-4-carbonic acid 84
Nitroso compounds, dissociation 4

Digitized by Google

Nitrous ether, determination 205
Nomenclature, of granolites 45
Nucleic acid: preparation, 4, 130; from different sources, analysis 187
Nux vomica, preparation 122

OIL: bergamot, assay, 123; corn, constants, 204; cottonseed, detection, 206; linseed, adulterations in, 205; saw palmetto, 102; walnut, 203; wood, composition 200
Oils: bromine and iodine absorption, 204; estimation of water in, 205; essential, adulterations, 123; heat of combustion, 204; Monarda, composition 102
Oleomargarine, simple test for 119, 179
Opium, assay 179
Ore sampler 15, 106
Ores: determination of copper in, 40; laboratory grinder for, 207; copper, leaching, 134; cupriferous, cyaniding, 217; gold, cyaniding, 25, 27, 29, 30, 31; gold, stamp-milling, 131; gold of Black Hills, 214; iron, 91, 94; iron, of Adirondacks, 91; magnetic iron, classification, 55; magnetite, determination of iron in, 35; manganese, 92, 95; pyrite, analysis, 33; silicious, smelting, 214; sulphide, determination of copper and nickel in, 38; telluride, treatment, 32; telluride and sulphide, Riecker process for, 133; tellurium of Colorado, 75; titanium, 60; uranium, analysis, 40; uranium of Colorado, 75; vanadium, analysis, 40; vanadium of Colorado, 75; zinc in Joplin district, 58; zinc, treatment, 59; zinc, Sadtler process for 59
Orthoclase soda, of peculiar habit 140
Osmotic membranes, preparation 160
Oxalic acid, origin from protein 188
α-Oxyanisylidene 5
Oxyazo compounds, constitution 164, 168, 172
Oxygen: spectrum, 191; effect on brass 214
Ozone, atmospheric 15

PALLADIUM: expansion at high temperature, 150; chloride, compound with methyl sulphide 129
Palmetto oil 102
Paraffin, use in preparing nux vomica 122
Parianite 68
Paris green: analysis, 177, 184; soluble arsenious oxide in 34, 87
Pathology, bio-chemical basis 103
Pea, production of nitric acid, by 130
Pentosans, estimation 121
Peppermint oil, analysis 205
Perchloric acid, behavior with bromine and iodine 100
Persulphates of rubidium, caesium, and thallium 14
Petrography of igneous rocks of Montana 94
Petrolene 107
Petroleum: California, composition, 210; Japanese, composition, 211; Texas, composition 5, 211
Phase rule 160
Phenacetolin, value as indicator for Hehner's method 117
Phenetol: action of sulphuric acid on, 85; disulphonic acid 85
m-Phenetolsulphonic acid 85
p-Phenetolsulphonic acid 85
Phenols, action on ethyl oxalate 164
Phenocrysts, origin in porphyritic granites 139
Phenyl ethers, derivatives 84
Phenylimidothiocarbonic acid derivatives 80
o-Phenylsulphonebenzoic acid and related compounds 123
Philippine Islands, mineral resources 93
Phloroglucinol, purification 6
Phosphates, estimation in water 118
Phosphorescence, effect of low temperature on 151

Digitized by Google

Phosphoric acid; Kilgore's volumetric method for, 86; determination as phosphomolybdic anhydride 33
Phosphorus pentabromide, dissociation in solvents 1
Piscidic acid 105
Piscidine 105
Plagioclasites of Minn 152
Plants, analysis for sulphur 121
Plate-amalgamation 24
Plates, name 134
Platinum: action of hydrochloric acid on, in presence of oxygen, 198; expansion at high temperatures, 150; loss in weight when heated; 14; metals, spectra 191
Polarization: gas, in lead accumulators, 115; of electrolytic cell, 193; of electrolytic cells, electromotive force, 116; plane, rotation by mixtures 206
Potassium: permanganate, effect on reduction of mercuric chloride, 12; perselenate, 196; sulphate, transference number 148
Potential, differences, between metals and non-aqueous solutions 115
Powder, explosive, requisites 110
Powders, smokeless, applications and properties 64
Precipitates, indirect weighing 175
Pressure: effect on electrolytic action, 192; high, apparatus for measuring, 2; osmotic relation between, and vapor pressure, 157; thermal 158
Pressure-volume, diagram 160
Process, patio in Mexico 12
Proteids, vegetable 186
Pseudocumenesulphonic acid, hydrolysis 150
Pseudothioureas 130
Psychotrine, presence in ipecacuanha 103
Pump, vacuum 225
Purple, London, composition and analysis 86
Pyridine, latent heat 151
Pyrite, smelting 133, 134
Pyrrhotite, determination, in pyrite ores 33

RADIUM, spectrum 191
Reaction, velocity 190
Reactions, reversible 202
Retene 107
Rhubarb, constituents 141
Rhus Canadensis, analysis 179
Rhus Glabra, analysis 179
Rock: analyses, statement, 39; bituminous, 95; phosphate, analyses 93
Rock-series, igneous 48
Rocks: classification, 45; gabbroid, of Minn., 52; granitic, of Pikes Peak, 47; igneous, classification, 51; igneous of Montana, 94; Italian volcanic, analyses, 87; mixed 48
Root tubercles, fixation of nitrogen by 130
Rubber: cultivation, in Gautamala, 111; in the Philippines 111
Rubidium; acid nitrates, 199; persulphate 14

SALICYLIC acid, detection in foods, 41; vapor-pressure 155
Salts: conductivity at 0° and 95°, 156; double constitution, 12; double, conductivity, 146, 147
Samarium, atomic weight 143
Sandstone, analysis 138
Schists, glaucophane, chemical composition 74
Selagite, analysis 87
Selenium: spectrum, 191; double halides with amines 6
Silica: determination in cement, 35; influence on loss in scorification 207
Silicates, temperature of formation in fusions 16
Silicic acid, separation from tungstic acid 174
Silicon: influence on condition in cast iron, 220; spectrum, 191; carbide, use in cupola practice 61

Digitized by Google

Silicons, rapid work on 99
Silk, artificial, manufacture 63
Silver: assay in copper materials, 208; extraction by plate-amalgamation, 214; expansion at high temperatures, 150; loss in scorification, 207; melting-point, 190; new volumetric method for, 36; quantitative determination by blowpipe, 207; refining, 18; refining at Globe Works, Colo., 17; recovery of waste, 182; separation from arsenic, 36; electrolytic precipitation and separation, 178; sulphocyanide, use in analysis, 98; veins of Idaho 93
Slags: analysis, 176; utilization of heat, 17; blast-furnace, determination of lime in, 39; chilled, determination of copper in, 38; lead and copper, analysis, 40; iron and manganese 176
Slate belt of New York and Vermont 90
Smelting: lead, 17, 18; pyritic, 133, 134; pyritic, in Black Hills, 214; at Grand Forks, 18; at Hall Mines, 18; in England 17
Smithsonite, analysis 138
Soaps, determination of free alkali in 34
Sodium: use in blowpipe analysis, 207; hypochlorite, use in bleaching, 182; hydroxide, estimation in presence of carbonates, 203; nitrate, decomposition by sulphuric acid, 197; nitrite, determination, 205; sulphate, transition temperature, 1; sulphite, action on tribromdinitrobenzol 166
Soil: analyses, 210; solutions 183
Soils: alkali, chemical examination, 183; Maryland, composition 122
Solutions: aqueous of non-electrolytes, freezing-point, 146; a new theory, 158; specific heat 153
Specific gravity tables 122
Spectra of various elements 191
Spectrum of atmospheric gases 150
Sperrylite, occurrence in North Carolina 88
Spirits, detection of coloring-matter in 119
Stamp-battery, efficiency 22
Stamp-mill, on Douglas Island 23
Stannous chloride: oxidation by free oxygen, 148; conductivity 148
Starch, presence in tree-trunks 105
Steel: corrosion, 60: corrosion, influence of copper on, 137; determination of sulphur in, 175; rapid determination of carbon in, 35; effect of heat-treatment on microstructure, 60; expansion at high temperature, 150; plant at Cape Breton, 135; low carbon, effect of annealing on 101
Steels: chrome and tungsten, analysis 98
Stibio-domeykite 76
Stone: artificial, 185; building, analyses, 92; building, statistics 96
Strontium, estimation as oxalate 176
Sugar, amount in beets 105
Sugar-beet waste, utilization 185
Sugars produced by hydrolysis of wood 105
Sulphides, separation by hydrochloric acid 36
o-Sulphobenzoyl chlorides, action on urea 127
Sulphocyanate, solutions, standardization 98
Sulphonchlorides: action on thiourea, 127; action on urea 126
Sulphur: determination in iron and steel, 175; determination in plants, 121; distribution in pig iron, 35, 99; influence on condition of carbon in cast iron, 220; spectrum 191
Sulphuric acid, preparation of standard solutions 87
Surface-tension of water above 100° 152
Sylvanite 76
System: periodic, 145; periodic, and properties of compounds 3

TALBOT open-hearth process 223
Tannin, comparison of methods for 107
Tanning materials, composition of ash 73
Tannins, analysis 4

Digitized by Google

Telluride ores: treatment, 133; of Colorado 75
Tellurium: compounds, physiological effects, 103; ores, treatment, 32; ores of Colorado, 75; double fluoride with caesium 200
Temperature: regulator, 161: transition, of sodium sulphate 1
Temperatures, high, determination 190
Δ^4-Terpen-3-one, reduction product 4
Terpenes of Aralia Nudicaulis 102
Tetraphenylmethane, attempt to prepare 86
Thallium: acid nitrate, 199; isomeric halogen compounds, 12; persulphate 14
Thallous thallic nitrate 199
Theorem: of Le Chatelier, 160; of Roozeboom, 160; van der Waals 160
Thermometer, gas, at high temperature 190
Thermometry, fixed point in 1
Thermostat, electrical 161
Thio acids, addition products 173
Thiol acids, action with alkyl thiocyanates 129
Thiocarbamic esters, molecular rearrangement 80
Thiosemicarbazidic esters 80
Thiourea: action of sulphonchlorides on, 127; derivatives 129
Thiourea-amidines 129
Thio-urea-imido esters 4
Thomsonite, occurrence 88
Thorium: double chloride with caesium, 200; atomic weight 143
Thymoquinone, presence in begamot oil 123
Tin: recovery, from tin plate, 182; separation from copper 97
Tintometer, Loribond 122
Titanium: distribution, 14; ores, working 60
Toluene, electrolytic oxidation 7
Topaz, mode of occurrence in Brazil 74
Toxic action of electrolytes 156
Toxicity of urine 104
Transference numbers, determination of, and influence of concentration on 148
Trees, trunks, hydrolysis 105
Tribromdinitrobenzol, action of sodium sulphite on 166
Tri-iodobenzene 167
α,β,β-Trimethyladipic acid 173
Trimethylamine, double salts 6
Triphenylchlormethane: preparation, 6, 85, 86; action of zinc on 124
Tripheuyl: methyl, 6; peroxide 6
Tritolylcarbinol 172
Tritolylchlormethane 172
Tungsten: estimation in steel, 98; alloys with nickel, cobalt, and chromium, 99; trioxide, separation from molybdenum trioxide 35
Tungstic acid, separation from silicic acid 174

URANIUM: atomic weight, 143; determination in ores, 40; electrolytic determination, 178; compounds, manufacture and use, 112; ores, analysis 75
Urea: action of sulphonchlorides on, 126: action of *o*-sulphobenzoyl chlorides on, 127; determination 142, 205
Urea-amidines 4
Urea-amido esters 4
Ureas, oxygen ethers 169
Urine: estimation of urea in, 142; toxic properties 104

VALENCIANITE 93
Vanadium: determination in ores, 40, 75; minerals in Colorado, 75; spectrum 191
Vapor-pressure, relations in mixed liquids 155
Vapors, solvent action 155
Velocity: of chemical reactions, 161; of chemical change, experiments illustrating, 3; reaction and equilibrium 156
Veratrine, test for 142

Digitized by Google

Vitellinic acid, analysis 187
Voltameter, copper 193
Voltages, decomposition, apparatus for measuring 115
Volume, atomic, significance of changing 159

WALNUTS, oil 203
Water: analysis, permanent standards for, 118; analysis, standard methods, 117; 180; determination of alkalinity, 117; determination of turbidity, 117; estimation of carbon dioxide in, 175, 180; determination in oils, fats, and waxes, 205; estimation of phosphates in, 118; softening, 70; supply, filtration in Pittsburg, 128; surface-tension above 100°, 152; treatment for boilers, 113; vapor, spectrum, 190; vapor-pressure up to 359°, 152; variation in specific heat, 189; viscosity 153
Waxes, estimation of water in 205
Weeds, destruction by chemicals 73
Wells, artesian, analysis of water from 118
Wheels, car, of cast iron 136
Weighing, indirect 175
Wine, test for adulteration 180
Wines: determination of acidity, 141; American, composition 120
Wood: distillation, 181; methods of fire-proofing, 65, 109; oil, composition 200

XENON: atomic weight, 143; separation from air 151
m-Xylenesulphonic acid, decomposition by hydrochloric acid 149

YTTRIUM, atomic weight 143

ZINC: alloys with aluminium, 135; melting-point, 190; electrolytic separation, 178; separation from cadmium, 202; separation from copper, 97; determination by ferrocyanide method, 40; volumetric determination, 177; recovery, from waste, 182; copper couple, preparation, 172; ethyl iodide, use in syntheses, 128; ores in Joplin district 58
Zirconium, spectrum 191

Digitized by Google

Digitized by Google